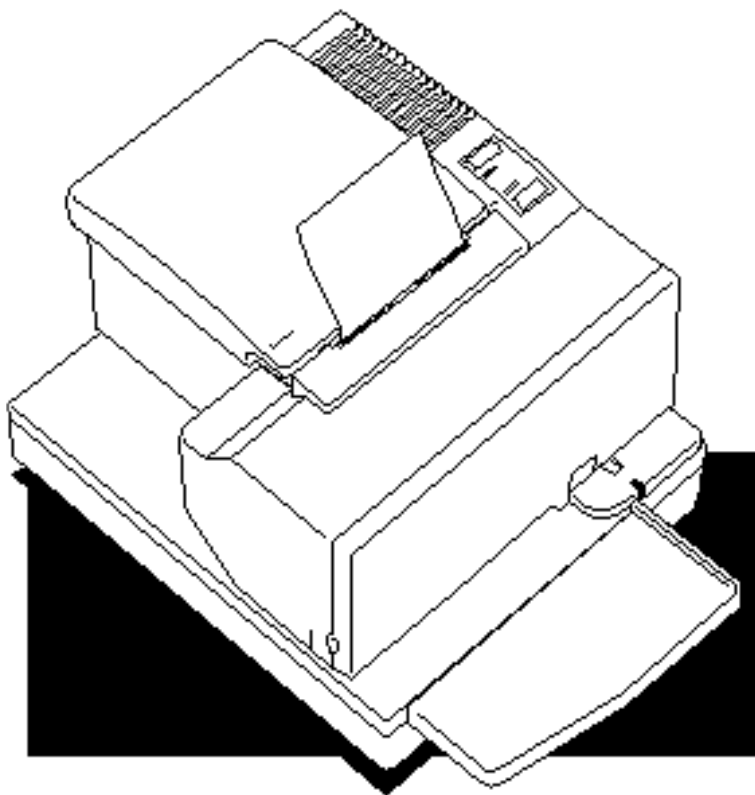


7156 Thermal Receipt and Impact
Slip Printer (RS-232)
Owner's Guide



7156-D100-V001

It is the policy of Axiohm IPB to improve products as new technology, components, software, and firmware become available. Axiohm IPB, therefore, reserves the right to change specifications without prior notice.

All features, functions, and operations described herein may not be marketed by Axiohm IPB in all parts of the world. In some instances, photographs are of equipment prototypes. Therefore, before using this document, consult your sales representative for information that is applicable and current.

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Federal Communications Commission (FCC) Radio Frequency Interference Statement

Warning

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

Information to User

This equipment must be installed and used in strict accordance with the manufacturer's instructions. However, there is no guarantee that interference to radio communications will not occur in a particular commercial installation. If this equipment does cause interference, which can be determined by turning the equipment off and on, the user is encouraged to contact Axiohm IPB immediately.

The Axiohm IPB company is not responsible for any radio or television interference caused by unauthorized modification of this equipment or the substitution or attachment of connecting cables and equipment other than those specified by Axiohm IPB. The correction of interferences caused by such unauthorized modification, substitution or attachment will be the responsibility of the user.

Quick Reference

This Quick Reference will direct you to key areas of the Owner's Guide. For a complete listing of topics, see the Contents or Index.

Ordering Paper and Supplies **page 5**

Where to order paper and other supplies.

Setting Up the Printer **page 11**

How to set up the printer.

Loading and Changing Paper **page 20**

How to change the receipt paper.

Validating and Verifying Checks **page 28**

How to validate and verify checks using the optional Magnetic Ink Character Recognition (MICR) Reader feature.

Testing the Printer **page 30**

Directions for running various print tests.

Solving Problems **page 33**

How to correct simple problems and get help for serious problems.

Diagnostics **page 41**

How to run the diagnostics.

RS-232C Interface **page 62**

Specifications for the RS-232C communication interface.

Commands **page 69**

Lists and descriptions of the programming commands.

How to Use This Book

Use this book as an installation guide for setting up and preparing the printer to run, as a training guide for teaching users how to operate the printer, or as a reference for programming the host system to communicate with the printer. The book also contains information about the character sets and graphics that are available. This book describes only RS-232C models of the 7156 printer.

See the Quick Reference, Contents, or Index for finding information.

Who Should Use this Book?

This Owner's Guide is intended as a general guide for operators and supervisors who need to know how to set up and use the printer. It is also intended as a technical guide for programmers and system integrators who need to know the technical information about the printer's communication and the programming commands that control the functions of the printer.

How to Obtain More Information

For more information about the 7156 printer please contact your sales representative.

For service and disassembly procedures, service training, and parts information, see the following items (you must be a trained service representative to service the printer):

- 7156 Thermal Receipt and Impact Slip Printer: Service Guide (7156-D200-V001)
- Field Service Course for 7156 Printer (7156-D400-V001)
- Parts Information Manual (7156-D300-V001)

For additional copies of the Owner's Guide, contact your sales representative.

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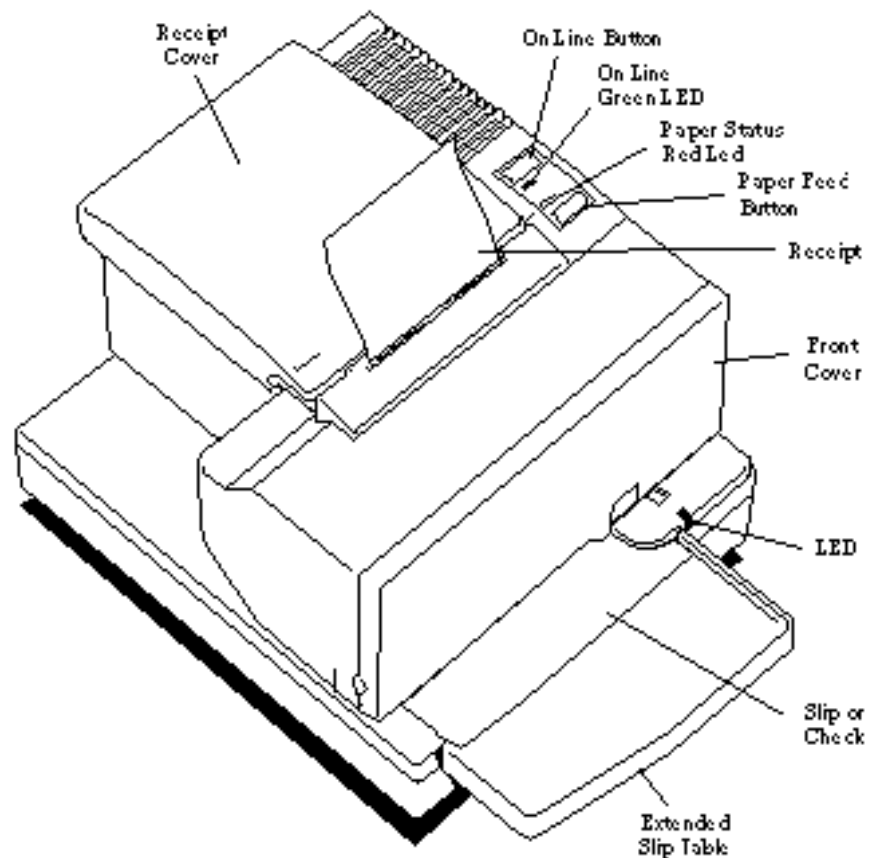
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About the 7156 Printer



The 7156 printer is a fast, quiet, relatively small and very reliable multiple function printer. It prints receipts, validates and prints checks, and prints on a variety of single- or multiple-part forms. There is no journal as it is kept electronically by the host system.

The industry-standard RS-232C communication interface allows the 7156 to be connected to any host PC or terminal system that uses RS-232C. Control codes are provided for easy migration of applications written for Epson as well as other Axiohm printers.

With thermal printing technology on the more frequently used receipt station, there is no ribbon cassette to change and paper loading is extremely simple. Printing on single- or multiple-part forms, validating checks, and printing checks is also easy in the accommodating slip station. An extra nice option is the Magnetic Ink Character Recognition (MICR) Reader with parsing which reads account numbers on checks for easy verification.

Features and Options

The 7156 printer comes with several features and options.

Receipt Station

- Thermal printing
- Standard pitch (host selectable): 15.2 characters per inch, 44 columns
- Compressed pitch (host selectable): 19.0 characters per inch, 56 columns
- Resident bar codes
 - Code 39
 - Code 128
 - UPC-A
 - UPC-E
 - JAN8 (EAN)
 - JAN13 (EAN)
 - Interleaved 2 of 5
 - Codabar
- Drop-in paper loading requiring no spindle or threading paper
- Paper low indicator
(not available on 30XX models; see the model number on the machine label on the right side of the printer)
- Paper exhaust
- Cover open

Slip Station

- Bi-directional, impact printing
- Standard pitch (host selectable): 13.9 characters per inch, 66 columns
- Compressed pitch (host selectable: 17.1 characters per inch, 80 columns)
- Printing of forms up to five plies
 - Front insertion of forms with forms stop Testing one two three four five six seven
 - Side insertion of forms with override of forms stop
 - Automatic and manual insertion of forms
- Form alignment sensors
- Horizontal slip table with optional extension (standard with MICR option)
- Cover open

Both Stations

- Variety of print modes: double high (receipt station only), double strike (slip station only), double wide, upside down, and rotated
- Two resident character sets:
 - PC Code Page 437 (US)
 - PC Code Page 850 (Multilingual)
- 16K RAM available for downloadable character sets or bit-mapped graphics (printing logos)

General Features

- Industry standard RS-232C communication interface
- History EEROM for custom settings
- Remote power supply
- Power and communication support for a remote 2x20 pass-through display
- Two cash drawer kickouts
- Audible tone (controlled by application)

Note: The 7156 does not use a paper journal. The journal is kept electronically by the host system.

Options

- Magnetic Ink Character Recognition (MICR) Reader built into the slip station for verifying checks
- Custom MICR field parsing
- Extended slip table for handling large forms (standard with MICR)
- Paper cutter (receipt station)

Thermal Printhead

The 7156 uses a thermal printhead (on the receipt station) for printing receipts, and it is extremely fast and quiet. Since it uses heat to print directly on paper, there is no cassette or ribbon to change, eliminating soiled fingers and paper dust.

There is no regularly scheduled maintenance for the printhead and it does not need to be regularly cleaned. However, if it does appear dirty, wipe it with cotton swabs and rubbing alcohol. If spotty or light printing problems persist after cleaning the printhead, contact a service representative. See “Contacting a Service Representative” in “Solving Problems” later in this book.

Note: The thermal printhead does not normally require cleaning if the recommended paper grades are used. If non-recommended paper has been used for an extended period of time, cleaning the printhead with cotton swabs and rubbing alcohol will not be of much benefit. See “Recommended Suppliers” on the next page for the recommended paper grades.

The printhead is designed for a very long life, but it may be replaced if needed. Only a trained service representative may replace the printhead. See “Solving Problems” to determine if the printhead needs to be replaced.

Impact Printhead

The bi-directional, impact printhead is designed for a very long life, but it may be replaced if needed. Only a trained service technician may replace the impact printhead. See “Solving Problems” later in this book to determine if the printhead needs to be replaced.

Ordering Paper and Supplies

Thermal receipt paper, ribbon cassettes, and forms can be ordered from several recommended and qualified suppliers.

Ordering Thermal Receipt Paper

The 7156 requires “fax grade” thermal paper with the following dimensions:

- Diameter: 80 mm maximum (3.15 in.)
- Length: 83 meters (273 ft.)
- Width: 80 mm +/- .5 mm (3.15 +/- .008 in.)

The paper must not be attached at the core. Otherwise the receipt station will be damaged when the paper is exhausted.

The paper low LED will blink when there are about 4 1/2 meters (15 feet) of paper left. If the paper runs out, the paper low LED stays on and the printer stops printing.

Note: The paper low feature is not available on 30XX models. See the model number on the machine label on the right side of the printer.

The host system will alert you that the paper in the receipt station is out (depending on the application program running in the host system).

Recommended Suppliers for Thermal Receipt Paper

The grades of paper listed here will give the best print quality. When more than one order number is listed, the first number provides better image density. You may order paper from the following suppliers:

AT&T Global Information Solutions Company

Media Products Division

9995 Washington Church Road

Miamisburg, OH 45342

Voice: 1(800)543-8130 (toll free), or local listing of Media Products sales office

Stock numbers: 878559 (standard density), 856966 (light density)

Kanzaki Specialty Papers

Imaging Products
20 Cummings Street
Ware, MA 01082-2002
Voice: 1(413)736-3216, 1(800)628-8386 (toll free)
Fax: 1(413)731-8864

Paper grade: F380 (standard density), F180 (light density)

In Japan:

New OJI Paper Co., LTD

4-7-5 Ginza Chuo-Ku
Tokyo, 104, Japan
Voice: (03)3563-4763
Fax: (03)3563-1136

Paper grade: KF-740-2EX (standard density), KF-740-1EX (light density)

In Germany:

Kanzan Spezialpapiere GMBH

Postlach 101141
Nippessstraße 5
D-5160 Duren, Germany
Voice: 011 49 2421 5924 20

Paper grade: KF-60 (standard density), KF-50 (light density)

Other Qualified Suppliers for Thermal Receipt Paper

The following suppliers sell thermal receipt paper which has been tested with the 7156 and may be used if desired. Contact your supplier for information.

Appleton Papers, Inc.

825-T F Wisconsin Avenue
P. O. Box 359
Appleton, Wisconsin 54912
Voice: 1(414) 734-9841

Paper grade: T1012

Arjo-Wiggins Thermal Papers, Ltd.

Whisby Road, North Hykeham
Lincoln, Lincolnshire LN6 9AU
England

Voice: 44 (0) 522 681212

Fax: 44 (0) 522 690972

Paper grade: S552, S662

Nippon Paper Industry Co., Ltd.

Business Communication Paper Division
Shin-Yurakucho Building
1-12-1, Yurakucho, Chiyoda-ku
Tokyo 100 Japan

Voice: 03-3218-8049

Fax: 03-3216-1397

Paper grade: TP50 KS

Ordering Ribbon Cassettes

To order ribbon cassettes, contact your sales representative or order directly from AT&T Global Information Solutions at the following address or toll free number:

AT&T Global Information Solutions Company

Media Products Division
9995 Washington Church Road
Miamisburg, OH 45342

Voice: 1(800)543-8130 (toll free), or local listing of Media Products sales office

Stock Numbers: 198161 (purple ribbon cassette—3 million characters)
198145 (black ribbon cassette—3 million characters)

Ordering Forms

The 7156 prints on single or multiple forms in the slip station (up to five-part forms). Forms and slips must meet the following requirements:

- Front insertion (minimum):
51 mm (2.0 in.) wide
70 mm (2.75 in.) long
- Side insertion (minimum):
203 mm (8.0 in.) wide
51 mm (2.0 in.) long
- Single-ply forms should be on paper that is greater than 15 pounds
- Multiple-part forms (up to five parts) should be no thicker than .406 mm (.016 in)

Contact your sales representative to order forms or you may order forms from AT&T Global Information Solutions at the following address or toll free number:

AT&T Global Information Solutions Company

Media Products Division

9995 Washington Church Road

Miamisburg, OH 45342

Voice: 1(800)543-8130, or local listing of Media Products sales office

Ordering the Power Supply and Cables

Contact your sales representative to order the supplies listed in the table. The numbers are for reference only. Suppliers may use other numbers.

Item	Type	Number
Power supply with attached cable to printer and U.S. power supply cord		7156-K330-V001
Power supply with attached cable to printer		7156-K301-V001
Power supply cord (to outlet)	United States	7156-K320-V001
	International	7156-K321-V001
	United Kingdom	7156-K322-V001
	S.E.V.	7156-K323-V001
	Australia	7156-K324-V001
Communication cables		
RS-232C 25-pin (host) to 9-pin	(3 meters—9.8 ft.)	1420-C001-0030
RS-232C 9-pin to 9-pin	(3 meters—9.8 ft.)	1416-C057-0030
Extended Slip Table		7156-K280-V001

Ordering Cash Drawers

The following cash drawers may be used with the 7156 printer:

- NCR Cash Drawer: Model 7052-K657 (switchable for drawer 1 or drawer 2)
- M-S Cash Drawer Corp.: Model EP-125 K series, EP 127, EP-102
- APG Cash Drawer: Model 322
- Indiana Cash Drawer: Model SLD

Maintaining and Cleaning the Printer

There is no customer maintenance required for the 7156. However, you may occasionally clean the cabinet as needed to remove dust and finger marks. Use any household cleaner designed for plastics, but test it first on a small unseen area. The cabinet materials and finish are durable and are resistant to the following items:

- Cleaning solutions
- Lubricants
- Fuels
- Cooking oils
- Ultraviolet light

If the receipt paper bucket is dirty, wipe it with a clean, damp cloth.

Caution: Do not spray or try to clean the thermal printhead or the inside of the printer with any kind of cleaner as this may damage the thermal printhead and electronics.

If the thermal printhead appears dirty, wipe it with cotton swabs and rubbing alcohol. If spotty or light printing problems persist after cleaning the thermal printhead, see “Solving Problems” later in this book.

Note: The thermal printhead does not normally require cleaning if the recommended paper grades are used. If non-recommended paper has been used for an extended period of time, cleaning the printhead with cotton swabs and rubbing alcohol will not be of much benefit. See “Ordering Thermal Receipt Paper” earlier in this chapter for the recommended paper grades.

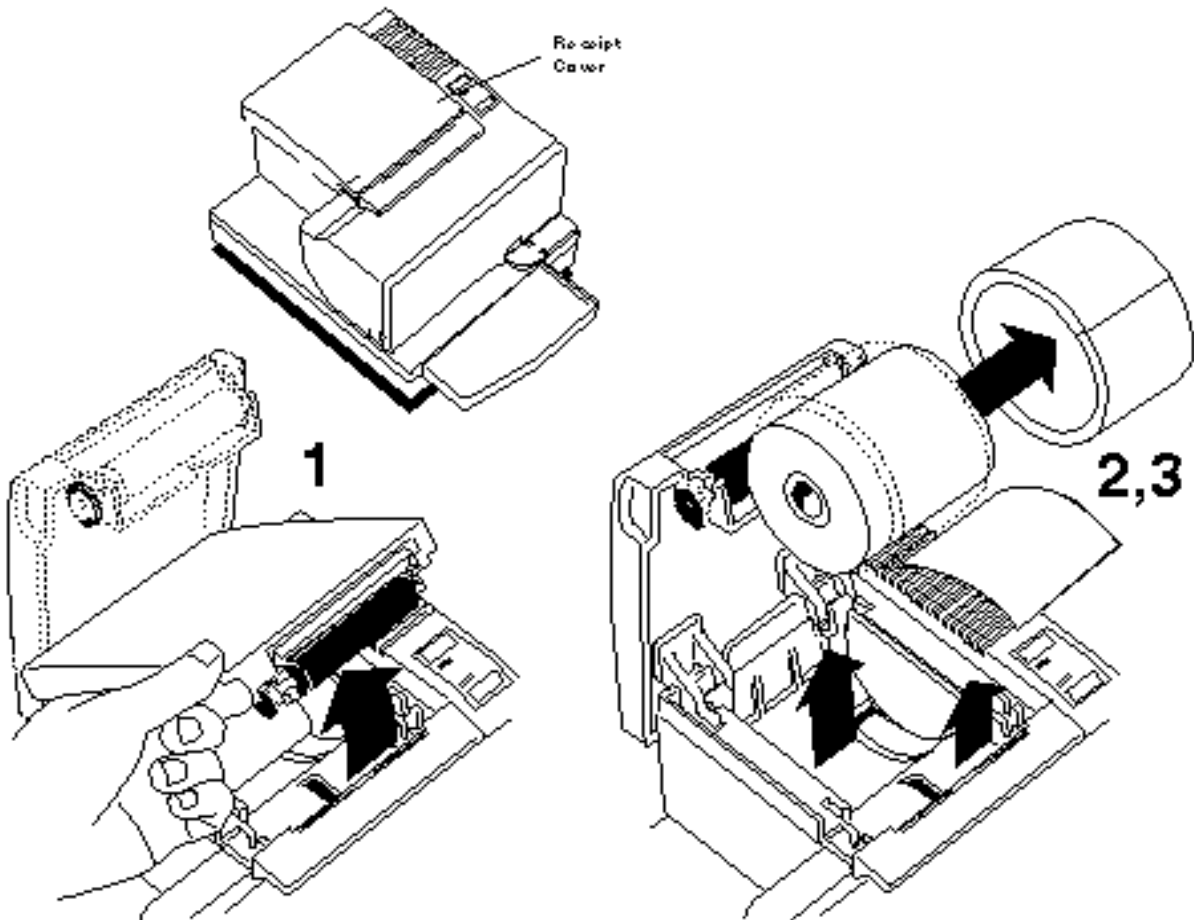
Setting Up and Using the Printer

What Is in the Box?

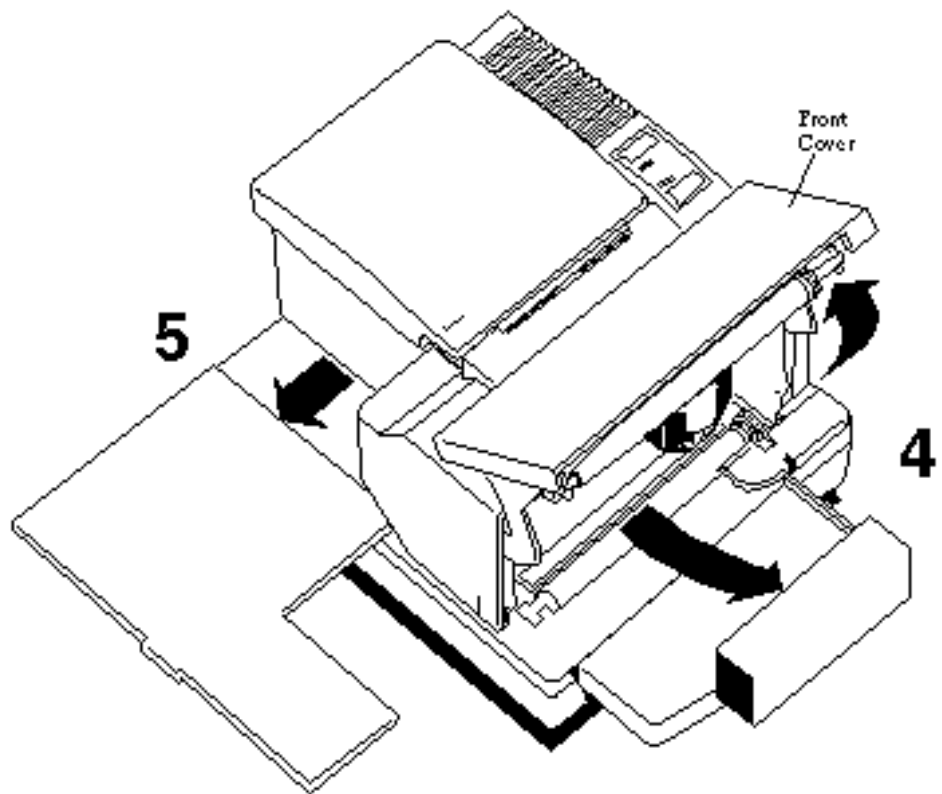
The following items are packed in the shipping box:

- Printer enclosed in a plastic bag and foam pack
 - Receipt paper roll, wrapped with a foam strip (inside receipt bucket)
 - Test printout protecting the thermal printhead (inside receipt bucket)
 - Cardboard support for cantilever (on slip table)
 - Foam restraint for carriage (behind front cover)
- Power supply with cable connecting to printer and power supply cord connecting to power outlet (these items are included if ordered with the printer)
- Ribbon cassette (in box)
- Installation Report Card
- Two strain relief bushings for routing cables through the back panel
- Self-adhesive clip for securing cables under the base

Removing the Packing Material



1. Once the printer is removed from the foam pack and plastic bag, open the receipt cover by pulling up on the front left corner.
2. Remove the paper roll and test printout from inside the receipt bucket.
3. Remove the foam strip from around the paper roll.



4. Open the front cover and remove the foam restraint.
5. Remove the cardboard support from the slip table.
6. Remove the ribbon cassette and cables from the box.
7. Save all packing materials for future storing, moving, or shipping the printer.

Caution: Be sure that the foam restraint and the cardboard support have been removed before operating the printer.

Repacking the Printer

1. Place a piece of receipt paper between the receipt cover and the printhead to protect the printhead.
2. Open the front cover and remove the ribbon cassette.
3. Move the carriage to the right and place the foam restraint between the left side of the printer and the carriage to protect the carriage.
4. Place the cardboard support on the slip table.
5. Place the printer in the plastic bag and foam pack.
6. Place the packed printer in the box and secure the box with packing tape.
7. Contact your Axiohm authorized service organization for information on where to send the printer.

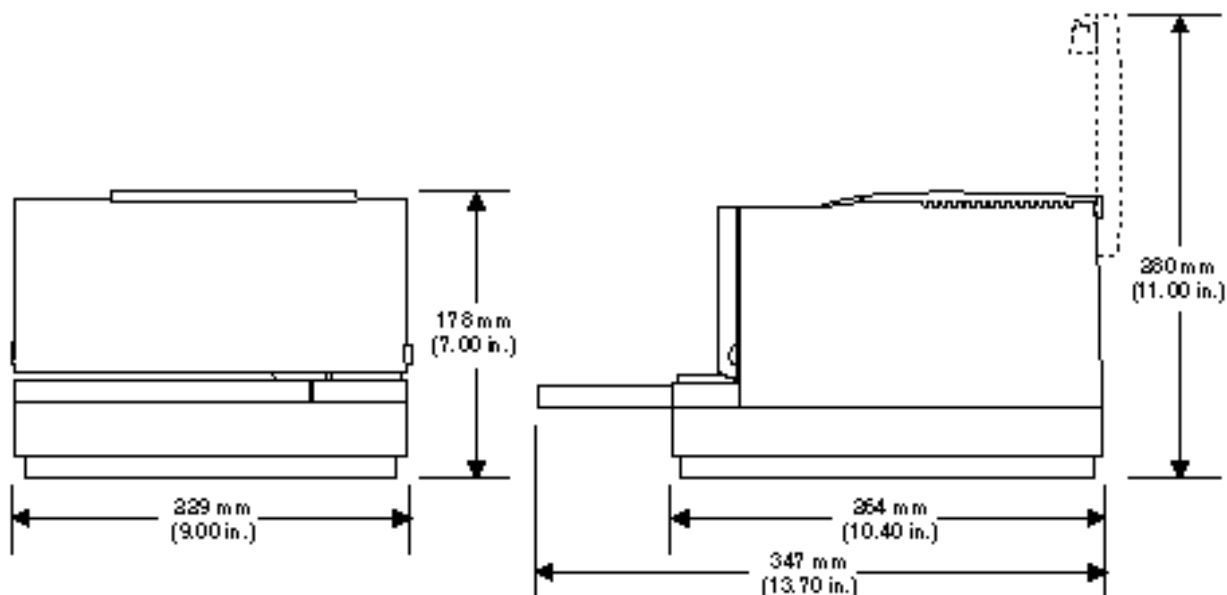
Be prepared to answer questions concerning shipping and billing.

Choosing a Location

The 7156 printer takes up relatively little counter space and may be set on or near the host system. Make sure there is enough room to open the receipt cover to change the paper and to open the front cover to change the ribbon cassette. The illustration shows the actual dimensions of the printer, but leave several inches around the printer for connecting and accessing the cables.

The optional Magnetic Ink Character Recognition (MICR) Reader feature has been factory adjusted for a normal operating environment with a host system. However, additional devices, such as CRT monitors, or large metal surfaces that are near the printer can affect the printer's magnetic field, causing intermittent reading errors when the MICR Reader is in operation.

This condition can be easily diagnosed by checking the MICR Reader adjustment which allows you to reset the MICR Reader if the factory setting has been altered by your operating environment. See "Adjusting the MICR Reader" later in this book.



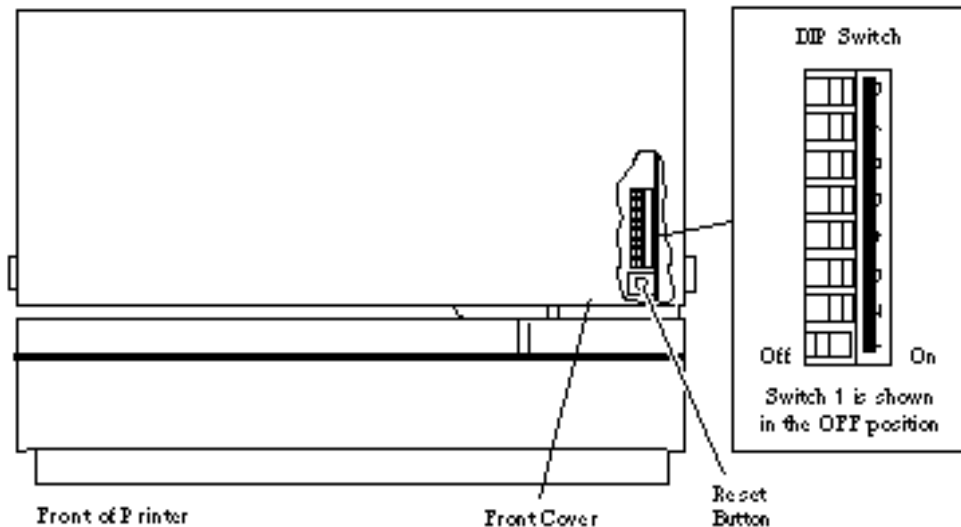
Setting Switches

The DIP switches, located behind the front cover, are used for three purposes:

- To set communication parameters for the RS-232C communication interface (see the switch settings on the next page)
- To set variables for several printer functions (see the sections for the various printer functions in “Level 1 Diagnostics” in the “Diagnostics” chapter for the switch settings)
- To perform diagnostic tests (see the sections for the various diagnostic tests in “Level 1 Diagnostics” in the “Diagnostics” chapter for the switch settings)

Caution: The DIP switches are set at the factory to predetermined settings and should generally not be changed. If you must change the settings do so carefully to avoid changing other functions.

Before changing any of the switches, first run the print test to print out the current switch settings on the receipt. See “Testing the Printer” at the end of this chapter for instructions on running the print test and for a sample printout.



Note: Switch 1 is shown in the Off position for reference.

Use a paper clip or other pointed object to set the switches.

1. Open the front cover.
2. Set the switches to the desired settings shown in the table.

Switch 1 must be set to Off for the on-line mode. Setting switch 1 to On puts the printer in level 1 diagnostics (setup mode). Changing the other switches in level 1 diagnostics can change settings that have been pre-set at the factory. See "Level 1 Diagnostics" later in this book for more information.

3. Close the cover.

DIP Switch Settings for RS-232C Parameters

Switch	Settings		Description
1	OFF		On-line Mode (default)
	ON		Level 1 Diagnostics (setup mode)
2	OFF		DTR / DSR Protocol (default)
	ON		XON / XOFF Protocol
3	OFF		Without Parity (default)
	ON		With Parity
4	OFF		Odd Parity
	ON		Even Parity
5, 6	5	6	
	OFF	OFF	19,200 Baud
	ON	OFF	9600 Baud (default)
	OFF	ON	4800 Baud
	ON	ON	1200 Baud

Connecting the Cables

There are three different types of cables that connect to the printer:

- Power supply cable supplying power from the power supply (see “Power Requirements” in Appendix A for more information about the power supply)
- Communication cable connecting the printer to the host system
- Cash drawer cables connecting the printer to one or two cash drawers

Caution: Be sure that all power is disconnected before connecting the cables.

Follow these steps to connect the cables to the printer and host system. See the illustration on the facing page.

1. Unplug the power supply's power cord if it is plugged in.
2. Route the power supply cable through the rear of the printer (an optional strain relief bushing is in the box) and through the cable clamp under the base.
3. Plug the power supply cable into the power connector under the base.
4. Plug the power cord into the power supply, then into an outlet.

At this point, the printer receives power. However, the printer is not “on-line” until the On Line button is pushed.

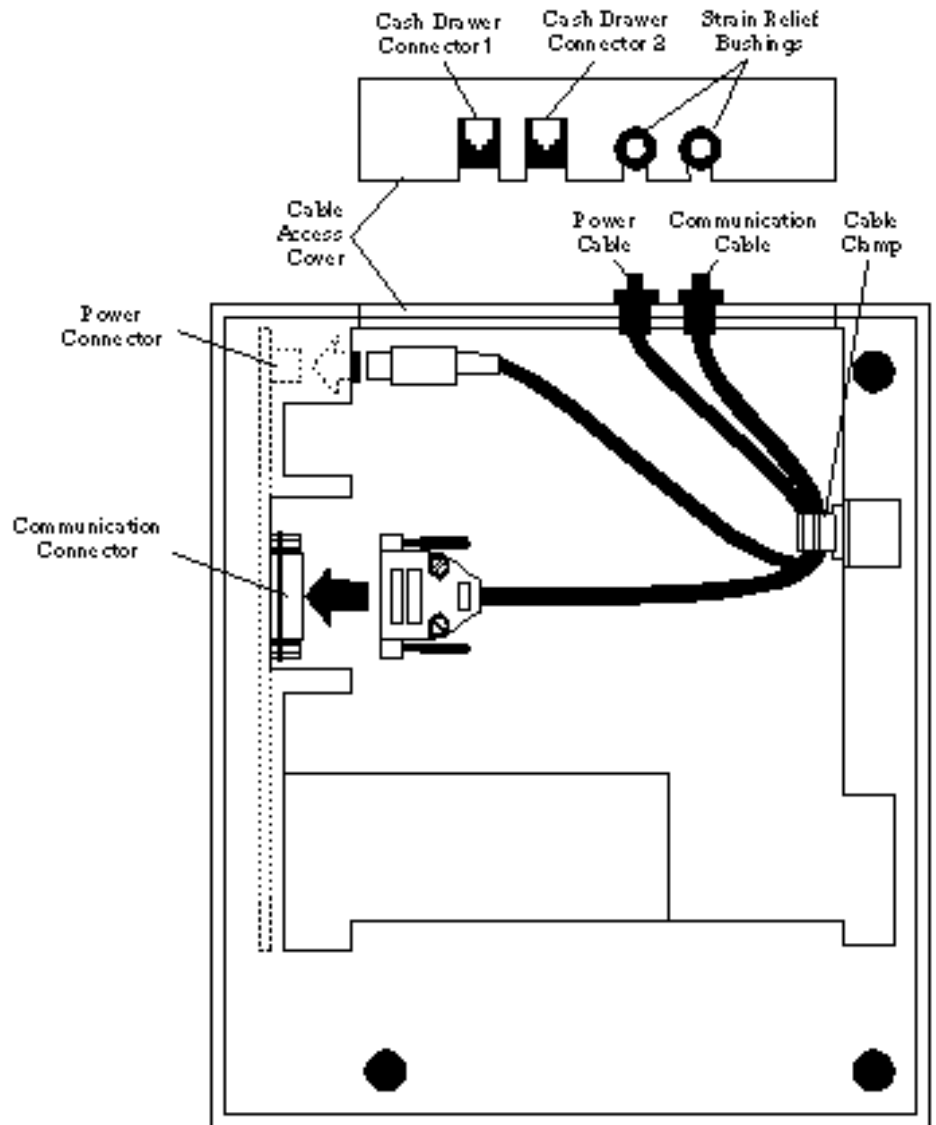
5. Route the communication cable through the rear of the printer (an optional strain relief bushing is in the box) and through the cable clamp under the base.
6. Connect the communication cable to the connector under the base.
7. Connect the communication cable to the appropriate host system connector.
8. Connect the cash drawer cables to the printer and cash drawers.

The connectors are standard phone jacks located in the back of the printer.

9. Press the On Line button on the operator panel to put the printer on-line.

The power LED (green) comes on indicating the printer is on-line.

The printer goes through a self-test routine to ensure everything is working properly then “beeps.” When the printer has completed its “startup” cycle, it is ready to receive data. If the printer doesn't start printing, or the host system indicates that there is a problem, see “Solving Problems” later in this book.



Bottom of the Printer

Note: The strain relief bushings and the cable clamp are shipped in the box and help secure the cables. Use either the cable clamp or strain relief bushings, or both to keep the cables from being accidentally unplugged and possibly damaging the connectors or interrupting a transaction.

Loading and Changing the Receipt Paper

The 7156 features extremely simple paper loading which is quick and efficient, saving both time and paper.

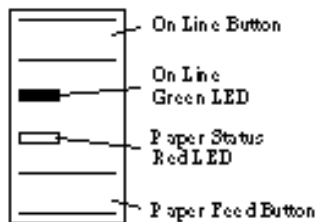
Caution: Do not operate the printer or host system if the printer runs out of paper. The printer will not operate without paper, but it may continue to accept data from the host system. Because the printer cannot print any transactions, the data may be lost.

Note: If you are loading paper for the first time and have already taken the roll out of the printer, go to "Putting In the Paper Roll" later in this chapter. If you have not taken the roll out, continue with the following instructions. Although the illustrations show a used roll being removed, the instructions apply to loading paper for the first time.

When to Change the Paper

You will need to change the paper when the paper low LED (red) flashes. There will be approximately 1 1/2 to 7 1/2 meters (5-25 feet) of paper remaining on the receipt roll. If the LED is turned on steady, the paper is out.

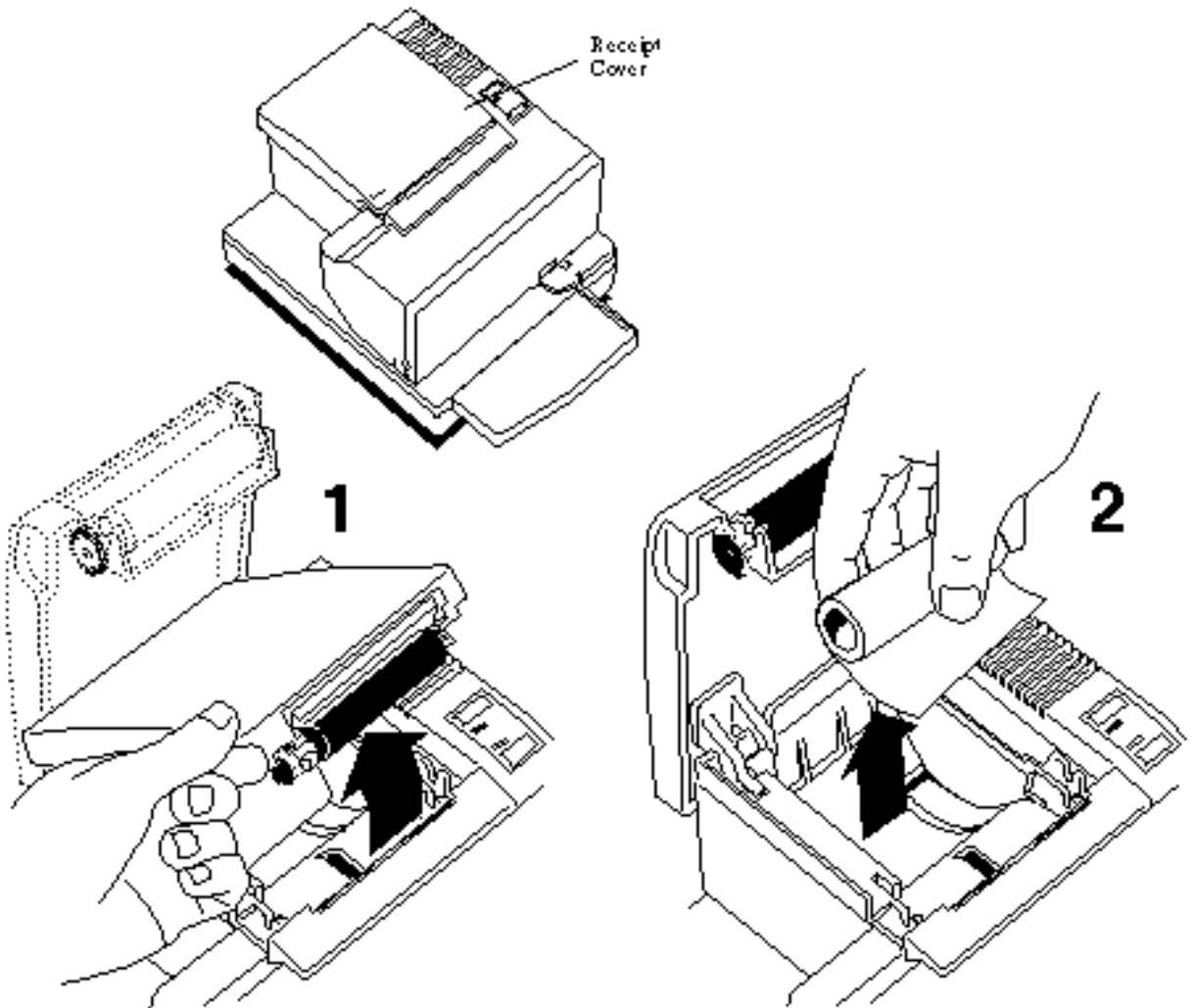
Note: The paper low feature is not available on 30XX models. See the model number on the machine label on the right side of the printer.



- LED blinks: paper is low (not available on 30XX models)
There are approximately 1 1/2 to 7 1/2 meters (5-25 feet) of paper remaining on the roll. Change the paper as soon as possible to avoid running out of paper part way through a transaction.
- LED on steady: paper is out
Change the paper now. Do not run a transaction without paper as the data may be lost.

Removing the Paper Roll

1. Open the receipt cover.
2. Remove the used roll.



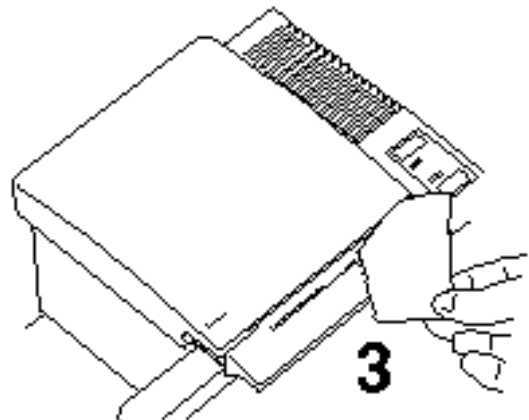
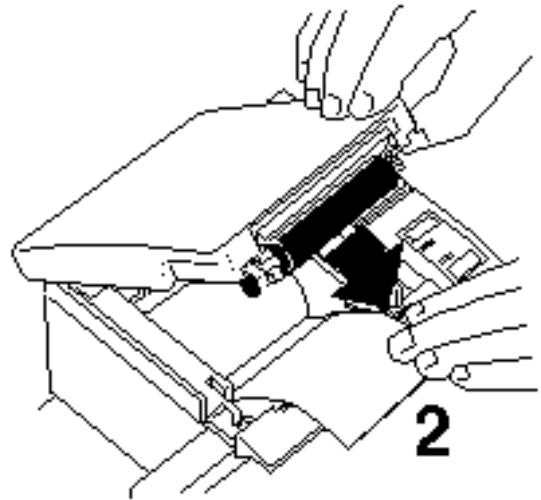
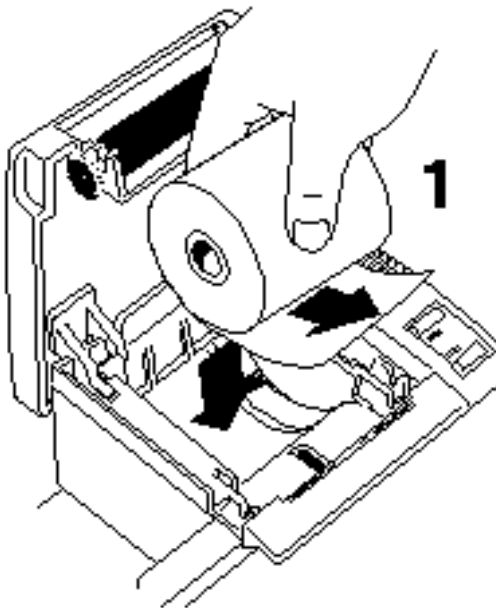
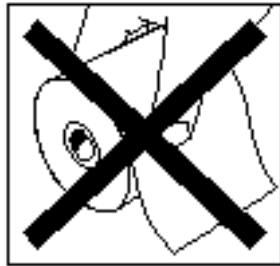
Putting In the Paper Roll

Note: Tear off the end of the new roll so that the edge is loose.

1. Place the new roll in the bin with a little extra paper extending over the front.

Be sure the paper unrolls from the bottom of the roll. Otherwise the paper will not be printed on because the thermal coating will be on the wrong side.

2. Close the receipt cover.
3. Remove the excess paper by tearing it against the tear-off blade.



Advancing Paper

1. Press the Paper Feed button on the operator panel to advance the paper.

The cover must be closed. To ensure print quality and the proper alignment of the paper, advance about 30 cm (12 inches) of paper.

2. Tear off the excess paper against the tear-off blade.

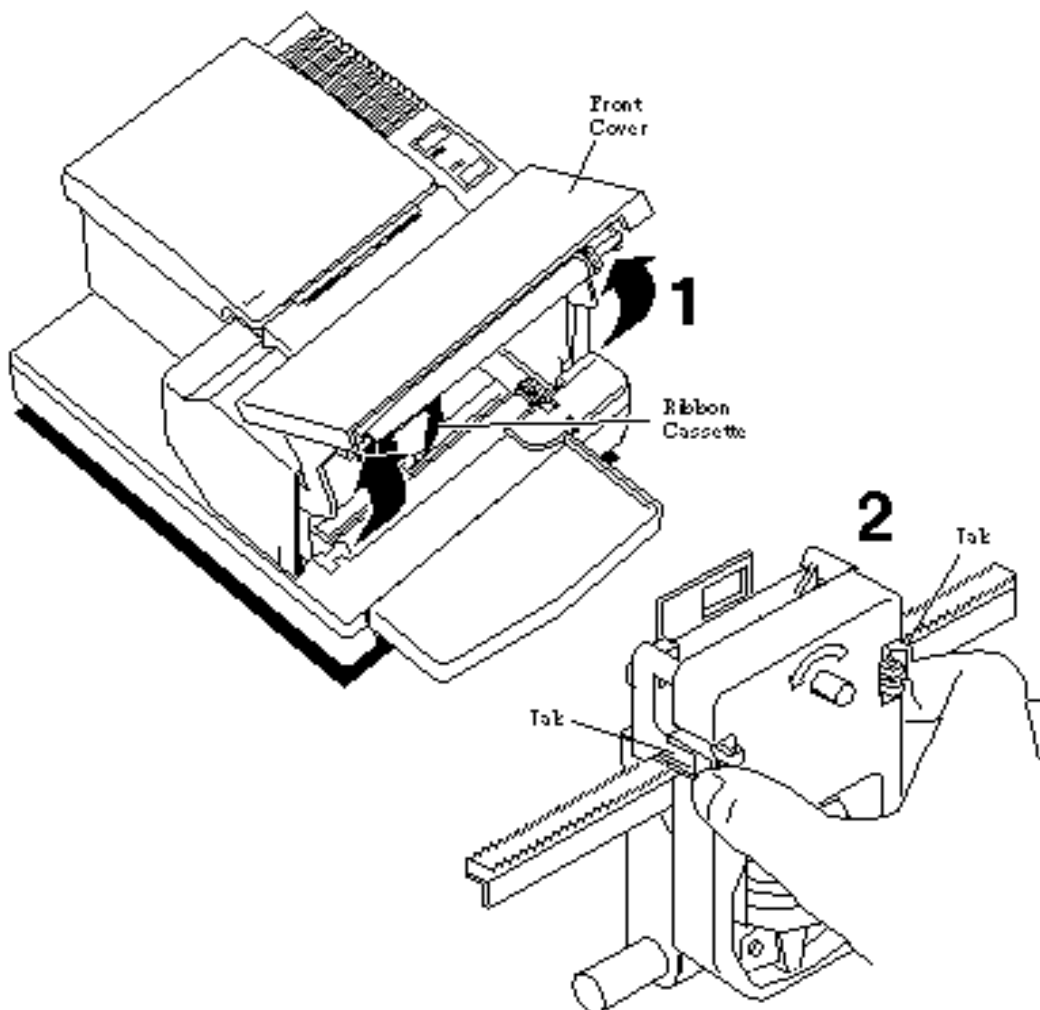
In addition to the tear off-blade, some printers have a knife which cuts the receipt after each transaction.

Putting In and Changing the Ribbon Cassette

Change the ribbon cassette when the print is too light or the ribbon is frayed.

Removing the Ribbon Cassette

1. Open the front cover.
2. Squeeze the tabs on the cassette and pull the cassette out of the printer.

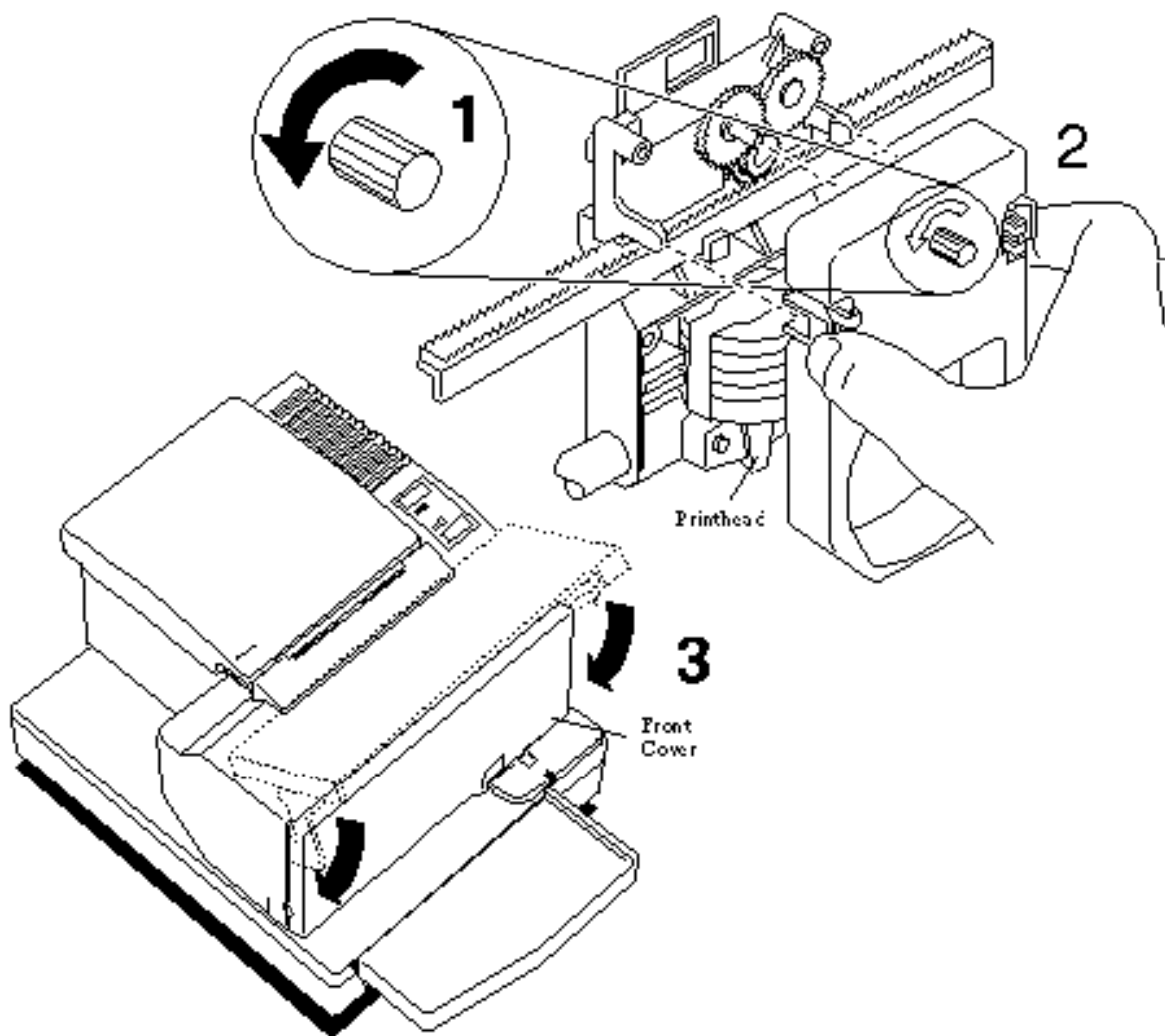


Putting In the Ribbon Cassette

1. Tighten the ribbon by turning the knob in the direction of the arrow.
2. Position the ribbon cassette on the carriage and snap it into place.

Be sure the ribbon is underneath the printhead.

3. Close the front cover.



Printing on Forms or Checks

There are several types of transactions that require you to insert a form or check into the printer:

- Credit card transaction (some credit card transactions may be printed on the receipt station and not require any forms)
- Multiple-part forms such as credit transactions or merchandise returns
- Electronic funds transfers
- Check printing (printing the date, payee, and amount on the check face)

Although the illustration on the facing page shows a check being inserted into the printer, the instructions apply to any type of form. The 7156 can print on forms up to five-parts thick. See “Ordering Forms” earlier in this book for more information about the type of forms that can be used.

1. Insert the form or check (check shown in the illustration) from the front and place it on the slip table top first and with the print side up.

If the form is extra long, you may need to insert it from the side.

2. Slide the form or check to the right until it lines up against the guide (wall).

If the form is extra long, you may need to slide it over the form stop to disengage it. In this case, you will need to mark the slip table for lining up the form for the proper placement of the print on the form.

3. Slide the form or check toward the back of the printer until it contacts the form stop (it won't be able to go any further);

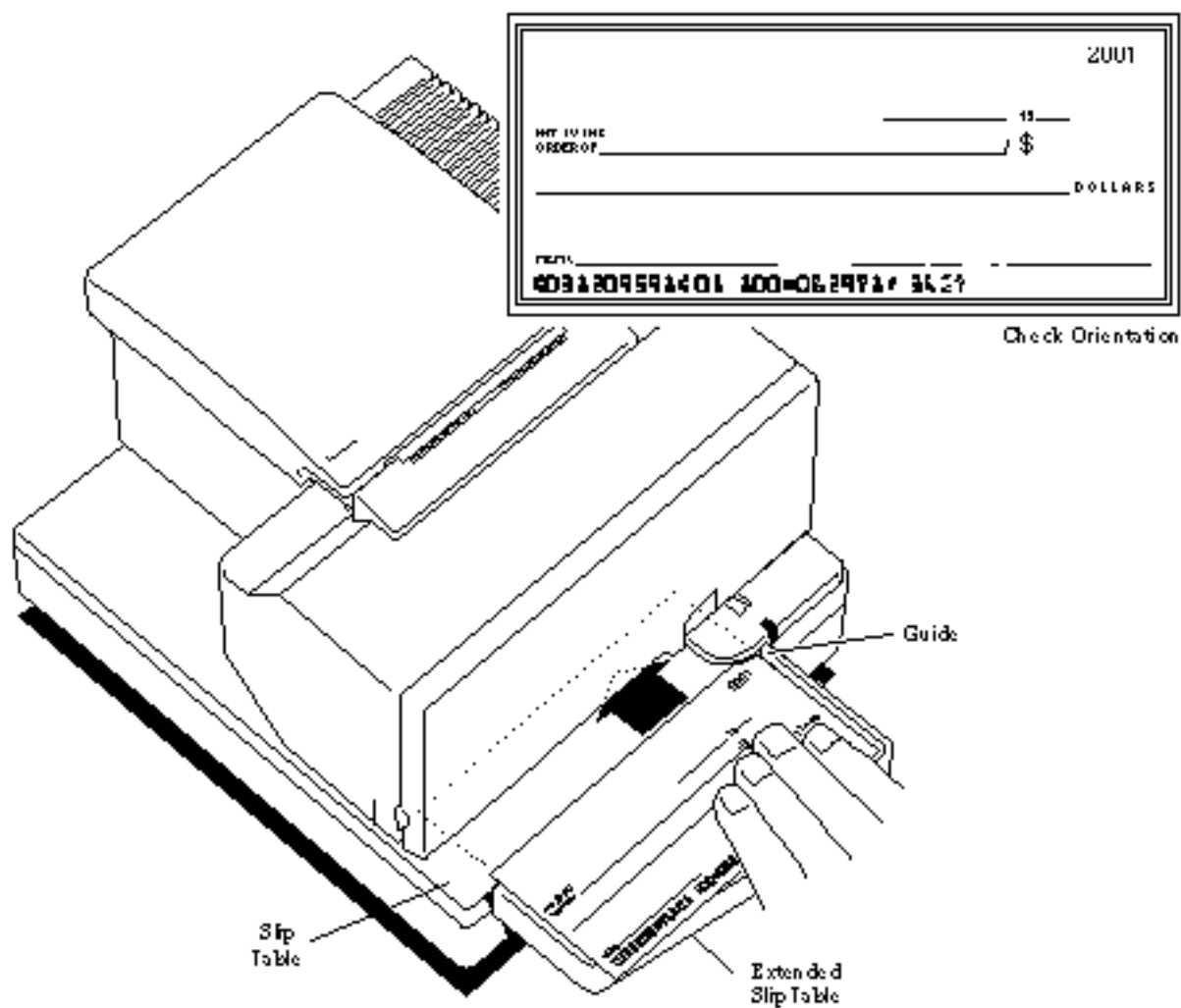
Or, align the form or check with any preset mark you may have made on the slip table for custom forms.

The green LED on the slip table turns on when the form or check is properly inserted (it has to cover two sensors on the slip table).

4. Follow the instructions from the host system.

The printer begins printing.

5. Remove the form or check after it has been fed back out.
6. Follow the instructions from the host system to finish the transaction.



Validating and Verifying Checks

Note: If the MICR Reader feature is present, checks are verified then validated.

1. Insert the check from the front and place it on the slip table face down as shown in the illustration.
2. Slide the check to the right until it lines up against the guide (wall).
3. Slide the check toward the back of the printer until it contacts the form stop (it won't be able to go any further);

Or, align the check with any preset mark you may have made on the slip table.

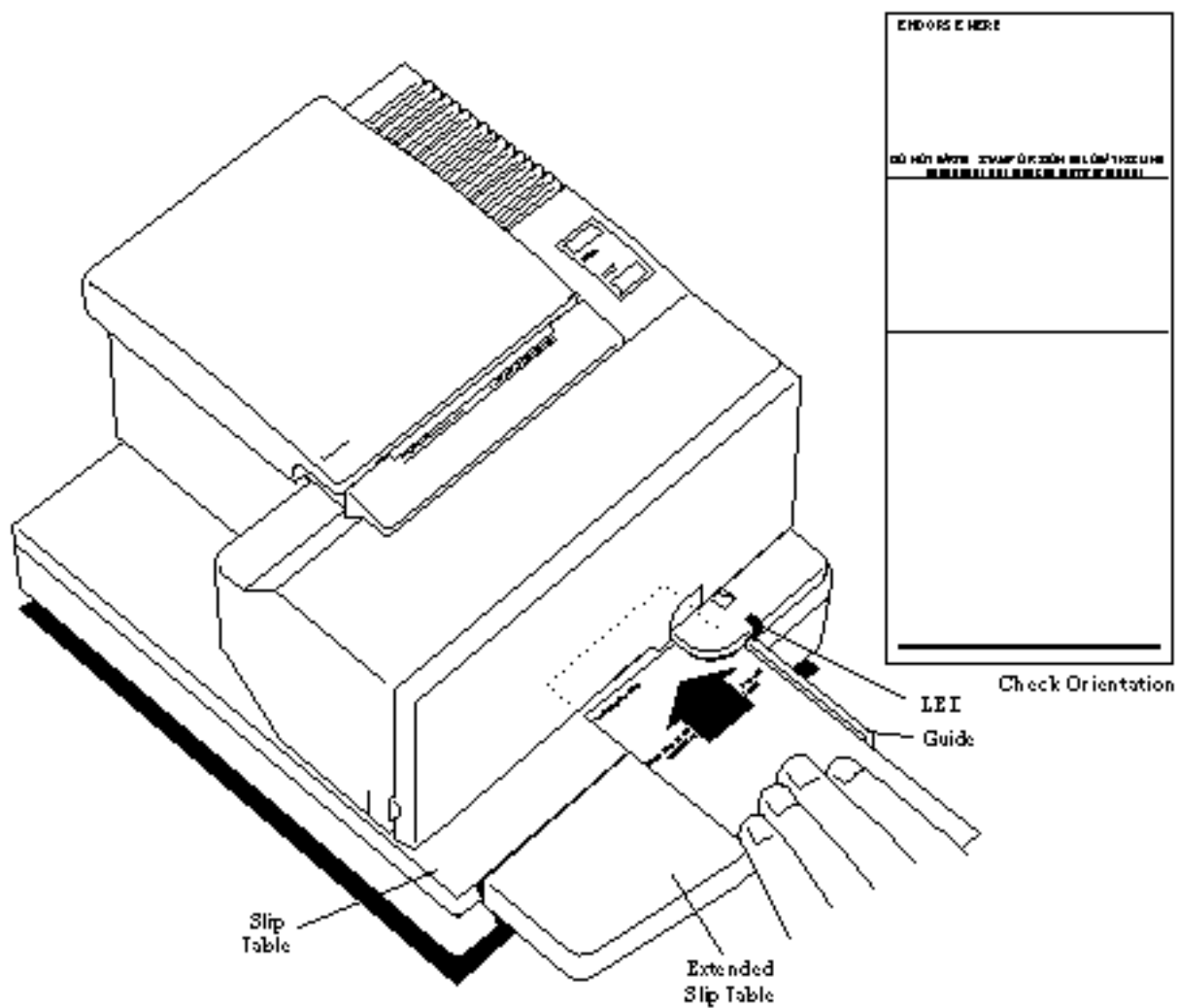
The green LED on the slip table turns on when the form or check is properly inserted (it has to cover two sensors on the slip table).

4. Follow the instructions from the host system.

If the MICR Reader feature is present, the check is fed in and out while the check numbers are read. If the check is verified as good, it is then validated. If the check is not verified as good, it is not validated.

Note: Do not hold or keep the check from moving during the MICR Reader transaction or the check numbers will not be read accurately.

5. Remove the check after it has been fed all the way back out.
6. Follow the instructions from the host system to finish the transaction.



Testing the Printer

Test the receipt station using the simple tests described in this section. To further test the receipt station or to test the slip station, run the level 1 diagnostic tests described in “Level 1 Diagnostics” in the “Diagnostics” chapter later in this book. See “Solving Problems” later in this book for what to do if the printer is not functioning properly.

The tests print various settings which can be used to check the printer's configuration. Give this to a service representative if there is a problem. The settings are listed in “Level 1 Diagnostics.” The tests also print all variations of the character set with a partial cut between each variation. See the samples at the end of this chapter. The tests end with a partial cut, then begin again. Several feet of paper can be used to print one pass of the test.

Running the Print Test by Power Cycling the Printer

1. Press and hold down the Paper Feed button on the top panel.
2. Press the On Line button.
3. Let go of the Paper Feed button once the printing begins.

The printer begins printing the data and character sets (see the sample).

4. To stop the test, press the Paper Feed button.

The printer is ready to receive and print data from the host system.

Running the Print Test by Opening and Closing the Cover

1. Open the receipt cover by pulling up on the front left side of the cover.

The LED (red) comes on indicating the receipt cover is open and that the printer cannot receive or print data (not that the paper is out).

2. Press and hold down the Paper Feed button while closing the receipt cover.
3. Let go of the Paper Feed button once the printing begins.

The printer begins printing the data and character sets (see the sample).

4. To stop the test, press the Paper Feed button.

The printer is ready to receive and print data from the host system.

Sample Print Test

```

7156 Thermal/Impact

Firmware CRC is 8D8B

Switches
 1 2 3 4 5 6 7 8
OFF OFF OFF OFF ON OFF OFF ON

Straps
RS232 comm Knife
MICR DC offset is 7C
MICR parsing is FF

Non-volatile memory
RS232 setup
-printL ? for error
-4K data buffer

Thermal Head Setting E
Partial Cut Setting 3
Datascopes Mode OFF
Print and feed w/ <CR>

thermal lines3,370,017
knife cuts 251,000
hours on 557

```

Paper Low Sensor

Note: The paper low sensor is not available on 30XX models. See the model number on the machine label on the right side of the printer.

The paper low sensor is set at the factory to detect when there are about 4 1/2 meters, +/- 3 meters (15 feet, +/- 10 feet), of receipt paper remaining. The sensor is adjustable to detect less or more paper remaining. It is recommended, however, that the sensor be kept at the factory setting.

If the sensor has accidentally been changed, follow these steps to re-adjust it. These steps will only get the sensor to an approximate position of the factory setting. To have the sensor reset to the exact setting as the factory setting, a service representative will need to be called. See “Contacting a Service Representative” later in this book.

1. Open the receipt cover.
2. Move the sensor along the cutout until it is as close as you can get it to the middle notch.

The other two notches are used for paper low settings in other printer configurations and can be ignored.

3. Close the receipt cover.

Note: Remember, this is only an approximation of the factory setting.

Solving Problems

The 7156 printer is a simple, generally trouble-free printer, but from time to time minor problems may occur. For example, the power supply may be interrupted or the thermal printhead may overheat.

A red LED on the operator panel signals that something may be wrong. The light on the front right side of the printer is used only to indicate when a form is inserted properly. It does not indicate an error.

For some problems, the printer communicates the information to the host system and relies on the application to indicate what the problem is.

The information on the following pages describes some problems that you may encounter: problems that you can easily fix, and others that you will need to contact a service representative for.

You may be able to correct many of the conditions or problems without calling for service. However, if a problem persists, contact a service representative. See “Contacting a Service Representative” at the end of this chapter.

Printer Beeps Twice

Problem	What to Do	Where to Go
Printer Beeps Twice at Power On	If printer beeps twice during level 0 diagnostics, it indicates that default values have been loaded into the EEROM. No action is necessary.	
If the printer beeps twice at every power on, the EEROM has failed	The PC Board needs to be replaced. Contact a service representative.	See “Contacting a Service Representative” later in this chapter.

Green LED Does Not Come On/Printer Will Not Print

Problem	What to Do	Where to Go
Cables may not be connected properly	Check all cable connections. Check that the host system and power supply are both on (the power supply is turned on by plugging it into an outlet).	See "Connecting the Cables."
Power supply may be defective	If the power supply is plugged in, but does not come on, you will need to order a new power supply.	See "Ordering the Power Supply and Cables."

Red LED Flashes

Problem	What to Do	Where to Go
Receipt paper is low*	There are about 4 1/2 meters, +/- 3 meters, (15 feet, +/- 10 feet) of paper left. Change the paper soon to avoid running out of paper part way through a transaction.	See "Loading and Changing the Receipt Paper."
*Note: The paper low feature is not available on 30XX models. See the model number on the machine label on the right side of the printer.		
Thermal printhead temperature is out of range	The printhead may overheat when printing in a room where the temperature is above the recommended operating temperature or when printing graphics continuously, regardless of the room temperature. In either case, the printer will shut off. If the temperature of the printhead is too hot, adjust the room temperature or move the printer to a cooler location. If the printhead is overheating because of printing graphics continuously, reduce the demand on the printer. If the printer continues to overheat, contact a service representative.	See "Environmental Conditions" in Appendix A for the recommended temperature range for operating the printer. See "Contacting a Service Representative" later in this chapter.
Power supply voltage is out of range	If paper is not low and no conditions indicate that the printhead is too hot, the power supply voltage is out of range. Contact a service representative.	See "Contacting a Service Representative" later in this chapter.

Red LED Is Constant

Problem	What to Do	Where to Go
Receipt paper is out	Change the paper now. Do not run a transaction without paper as the data may be lost.	See "Loading and Changing the Receipt Paper."
Receipt cover or front cover is open	Close the cover. The printer will not operate with either of the covers open.	
Knife failure	Open the receipt cover and check the knife. Clear any jammed paper you can see. Tear off any excess paper against the tear-off blade.	
	Contact a service representative if this does not resolve the problem.	See "Contacting a Service Representative" later in this chapter.
Paper jam in slip station	Open the front cover and check the slip table and under the carriage. Remove any paper you see.	
	Close the front cover. Press the On Line button twice to reset the printer.	
	If you cannot see a paper jam or other obstruction, contact a service representative.	See "Contacting a Service Representative" later in this chapter.

Slip or Forms Printing is Light

Problem	What to Do	Where to Go
Ribbon cassette is worn	Replace the ribbon the cassette.	See “Putting In and Changing the Ribbon Cassette.”
	Contact a service representative if this does not resolve the problem.	See “Contacting a Service Representative” later in this chapter.

Receipt Printing is Light or Spotty

Problem	What to Do	Where to Go
Thermal printhead may be dirty	Open the receipt cover and clean the thermal printhead with cotton swabs and rubbing alcohol.	See “Putting In and Changing the Ribbon Cassette.”
	Contact a service representative if this does not resolve the problem.	See “Contacting a Service Representative” later in this chapter.

Note: The thermal printhead does not normally require cleaning if the recommended paper grades are used. If non-recommended paper has been used for an extended period of time, cleaning the printhead with cotton swabs and rubbing alcohol will not be of much benefit. See “Ordering Thermal Receipt Paper” earlier in this book for the recommended paper grades.

LED (Slip Table) Does Not Come On

Problem	What to Do	Where to Go
Form or check not inserted properly	Line up the form or check against the guide (wall) and slide it toward the back of the printer until it contacts the form stop and can't go any further. Extra long forms may need to be inserted from the side to disengage the form stop. Contact a service representative if this does not resolve the problem.	See "Printing on Forms or Checks" or "Validating and Verifying Checks." See "Contacting a Service Representative" later in this chapter.

Forms Skew or Catch

Problem	What to Do	Where to Go
Form or check skewing or catching in slip station due to an obstruction or paper jam	Open the front cover and check for any paper jams or obvious obstruction in the slip station. Clear the obstruction or jammed paper. Contact a service representative if this does not resolve the problem.	See "Contacting a Service Representative" later in this chapter.

MICR Not Reading Properly

Problem	What to Do	Where to Go
MICR (Magnetic Ink Character Recognition) Reader does not read or misreads checks	Readjust the MICR Reader.	See “Adjusting the MICR Reader” in the “Diagnostics” chapter.

The optional Magnetic Ink Character Recognition (MICR) Reader feature has been factory adjusted for a normal operating environment. However, additional devices, such as CRT monitors, or large metal surfaces that are near the printer can affect the printer's magnetic field, causing intermittent reading errors when the MICR Reader is in operation.

This condition can be easily diagnosed by checking the MICR Reader adjustment which allows you to reset the MICR Reader if the factory setting has been altered by your operating environment. If you have to adjust the MICR Reader frequently, you may want to move the printer away from metal surfaces or CRT monitors.

Other Serious Problems

The following problems all need to be corrected by a qualified service representative. See the next section, “Contacting a Service Representative.”

- MICR Not Operating Properly
- Forms Not Feeding Into the Slip /Forms Printer
- Missing Dots in Slip or Forms Printing
- Printer will not cycle or stop when required
- Illegible characters
- Paper will not feed
- Knife will not cycle or cut
- Platen will not open or close
- Printer will not communicate

Contacting a Service Representative

For serious problems, such as the printer not printing, not communicating with the host system, or not turning on, contact your Axiohm authorized service organization to arrange for a service call.

For self-maintenance organizations, a service guide, parts manual, and self-study service course are available from Axiohm:

- 7156 Thermal Receipt and Impact Slip Printer: Service Guide (7156-D200-V001)
- Parts Information Manual (7156-D300-V001)
- Field Service Course for 7156 Printer (7156-D400-V001)

Diagnostics

The following diagnostic tests are available for the 7156:

- Level 0 Diagnostics
Performed during the startup cycle
- Level 1 Diagnostics (setup mode)
Available in a dedicated environment and accessed through the DIP Switches
- Level 2 Diagnostics
Performed during normal operation
- Level 3 Diagnostics
Maintained during normal operation and printed in the print test
- Print Test
Performed in off-line mode

Level 0 Diagnostics

The printer automatically performs level 0 diagnostics when the printer is put on-line. Level 0 diagnostics comprise the following actions:

- Motors and solenoids are turned off.
- Microprocessor timing is checked, CRC check of the firmware ROM is performed, external RAM is read.
 - The green LED on the slip table flashes once if this action succeeds.
 - Level 0 diagnostics stop if this action fails. Failure is indicated by the printer going dead: knife and printhead do not home, the platen does not open, LEDs are not lit, the printer is unable to communicate with the host.
- Knife is homed. A fault condition is caused if this action fails.
- Slip platen is opened.
- Slip printhead is homed. A fault condition is caused if this action fails.
- The status of all sensors is checked, and the status bytes are updated.

If the printer has not been turned on before, or a new EEROM has been installed, the default values for the printer functions will be loaded into the EEROM during level 0 diagnostics. This action will be signaled by two beeps. These values can be changed in level 1 diagnostics. See “Level 1 Diagnostics” for the functions and their settings.

If the printer continues to beep twice each time it is turned on, it is an indication that the EEROM has failed.

When the last step is complete, the Paper Feed button is enabled and the printer is ready for normal operation. Information about the tests is available to the communication interface through the commands.

Level 1 Diagnostics

Level 1 diagnostics (setup mode) allow you to change the settings for various printer functions and to run certain tests using the DIP switches.

Keep the following information in mind when changing the settings:

- The settings can only be changed when the printer is in level 1 diagnostics (setup mode): Switch 1 must be set to On. “Verifying Read of MICR Characters” is an exception as it is run in on-line mode (switch 1 set to Off).
- After the switches have been changed, press the on-line button and wait for the green LED to flash. This does not always apply. See the section for each function and test for specific instructions.
- The default options are set at the factory and are stored in the history EEROM.
- Once the settings have been changed and stored in the EEROM, the DIP switches must be set back to the on-line settings for the printer to operate.
- The stored settings for the functions are printed with a dump of all resident characters during a print test. See “Print Test” later in this chapter.

Caution: If you are changing the switch settings, be sure they are the correct settings for that particular function or test to avoid accidentally changing the settings for another function or test. If the settings are accidentally changed, use the switch settings shown in the tables throughout this section to change those settings back. If you need assistance, contact a service representative. See “Contacting a Service Representative” earlier in this book.

The functions and tests are described in the following order in this section:

- Setting printhead resistance
- Setting partial cut distance
- Setting Data Error and Data Buffer Options
- Ignoring/using the carriage return
- Checking and Adjusting the MICR Reader
- Verifying Read of MICR characters
- Running the data scope mode
- Testing the slip and receipt stations

Setting Printhead Resistance

This function changes the setting for the thermal printhead resistance. The setting must match the letter (A-H) stamped on the heatsink in back of the printhead, visible by removing the top cover of the printer. Please see the 7156 Service Guide for information on removing the top cover. This procedure should only be performed by a trained service representative.

Caution: The DIP switches are set at the factory to predetermined settings and should generally not be changed. If you must change the settings do so carefully to avoid changing other functions. Run the print test to see what the current setting for this function is. See “Print Test” later in this chapter.

- 1. Open the front cover and set the DIP switches to the setting shown in the table that matches the letter stamped on the heatsink in back of the printhead.

Switch 7 is always Off. Switch 8: On = knife, Off = non-knife

Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6	Printhead Setting
On	On	On	Off	Off	Off	A
On	On	On	Off	Off	On	B
On	On	On	Off	On	Off	C
On	On	On	Off	On	On	D
On	On	On	On	Off	Off	E
On	On	On	On	Off	On	F
On	On	On	On	On	Off	G
On	On	On	On	On	On	H

- 2. Close the front cover and press the On Line button.
The green LED flashes when the printer cycles.
- 3. Set the DIP switches back to the settings for normal operation (on-line mode).
See “Switch Settings” in the “Communication” chapter for the settings.
- 4. Close the front cover and press the On Line button.
The green LED flashes when the printer cycles.

Setting Partial Cut Distance

This function changes the length of the partial knife cut: the higher the number, the longer the cut.

Caution: The DIP switches are set at the factory to predetermined settings and should generally not be changed. If you must change the settings do so carefully to avoid changing other functions. Run the print test to see what the current setting for this function is. See “Print Test” later in this chapter.

1. Open the front cover and set the DIP switches to the setting in the table that matches the value you want for the length of the cut.

Switch 7 is always Off. Switch 8: On = knife, Off = non-knife

Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6	Value for Length of Knife Cut
On	On	Off	Off	Off	Off	0
On	On	Off	Off	Off	On	1
On	On	Off	Off	On	Off	2
On	On	Off	Off	On	On	3
On	On	Off	On	Off	Off	4
On	On	Off	On	Off	On	5 (Default)
On	On	Off	On	On	Off	6
On	On	Off	On	On	On	7

2. Close the front cover and press the On Line button.
The green LED flashes when the printer cycles.
3. Set the DIP switches back to the settings for normal operation (on-line mode).
See “Switch Settings” in the “Communication” chapter for the settings.
4. Close the front cover and press the On Line button.
The green LED flashes when the printer cycles.

Setting Data Error and Data Buffer Options

This function allows you to select the handling of data reception errors and to select the size of the data buffer.

Caution: The DIP switches are set at the factory to predetermined settings and should generally not be changed. If you must change the settings do so carefully to avoid changing other functions. Run the print test to see what the current settings for these options are. See “Print Test” later in this chapter.

- 1. Open the front cover and note what the current DIP switch settings are.
- 2. Set the DIP switches to the settings in the table you want for data reception errors and the data buffer.

Switch 7 is always Off. Switch 8: On = knife, Off = non-knife

Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6	Option
On	Off	On	Off	Off	Off	Print “?” for Data Errors (Default)
On	Off	On	Off	Off	On	Ignore Data Errors
On	Off	On	Off	On	Off	Set Data Buffer = 4K Bytes (Default)
On	Off	On	Off	On	On	Set Data Buffer = One Line

Choose one of the Data Errors options and one of the Data Buffer options. Other possible settings are not used.

- 3. Close the front cover and press the On Line button.
The green LED flashes when the printer cycles.
- 4. Set the DIP switches back to the settings for normal operation (on-line mode).
See “Switch Settings” in the “Communication” chapter for the settings.
- 5. Close the front cover and press the On Line button.

The green LED flashes when the printer cycles.

Ignoring/Using the Carriage Return

This function allows the printer to ignore or use the Carriage Return (Hex 0D) command depending on the application. Some applications expect the command to be ignored while others use the command as a print command.

Caution: The DIP switches are set at the factory to predetermined settings and should generally not be changed. If you must change the settings do so carefully to avoid changing other functions.

1. Open the front cover and set the DIP switches to the settings in the table you want for ignoring or using the Carriage Return command.

Switch 7 is always Off. Switch 8: On = knife, Off = non-knife

Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6	Option
On	Off	On	On	Off	On	Ignore CR (Hex 0D)
On	Off	On	On	Off	Off	Use CR (Hex 0D) as Print Command (Default)*

*Emulates the NCR 7150™ printer.

2. Close the front cover and press the On Line button.
The green LED flashes when the printer cycles.
3. Set the DIP switches back to the settings for normal operation (on-line mode).
See “Switch Settings” in the “Communication” chapter for the settings.
4. Close the front cover and press the On Line button.
The green LED flashes when the printer cycles.

Checking and Adjusting the MICR Reader

The adjustment procedure described in this section cancels or sharply reduces extraneous signals picked up by the Magnetic Ink Character Recognition (MICR) Reader.

Note: The MICR Reader feature has been factory adjusted for a normal operating environment with a host system. However, additional devices, such as CRT monitors or large metal surfaces near the printer, can affect the printer's magnetic field, causing intermittent reading errors when the MICR Reader is in operation.

This condition can be easily diagnosed by checking the MICR Reader adjustment and readjusting it if the factory setting has been altered. Follow the procedures in this section to check and adjust the MICR Reader.

Check the MICR Reader Adjustment

Caution: Electro Static Discharge may damage the PC board. Wear a grounded wrist strap and use a static mat or other ESD protected work surface whenever you work with the PC board.

- 1. Open the front cover.
- 2. Press the On Line button to take the printer off-line.

Caution: The DIP switches are set at the factory to predetermined settings and should generally not be changed. If you must change the settings do so carefully to avoid changing other functions.

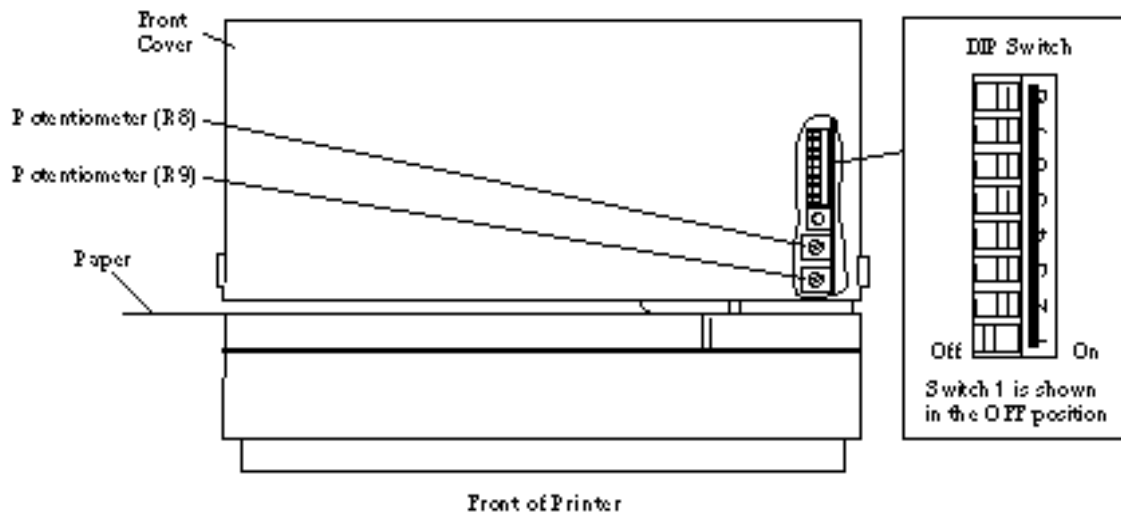
- 3. Set the DIP switches to the settings in the table.

See the illustration on the next page for the location of the DIP switches.

Switch 8: On = knife, Off = non-knife

Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6	Switch 7
On	Off	Off	Off	Off	Off	On

- 4. Close the front cover.
- 5. Press the On Line button to put the printer back on-line.



6. Insert a blank slip into the slip station from the left side so that it covers the MICR read head, but does not come into contact with the feed rolls.

The slip should be the same thickness as a normal check, with no magnetic ink characters printed on it. Keep the slip from moving during the procedure. Keep the slip out of the feed rolls.

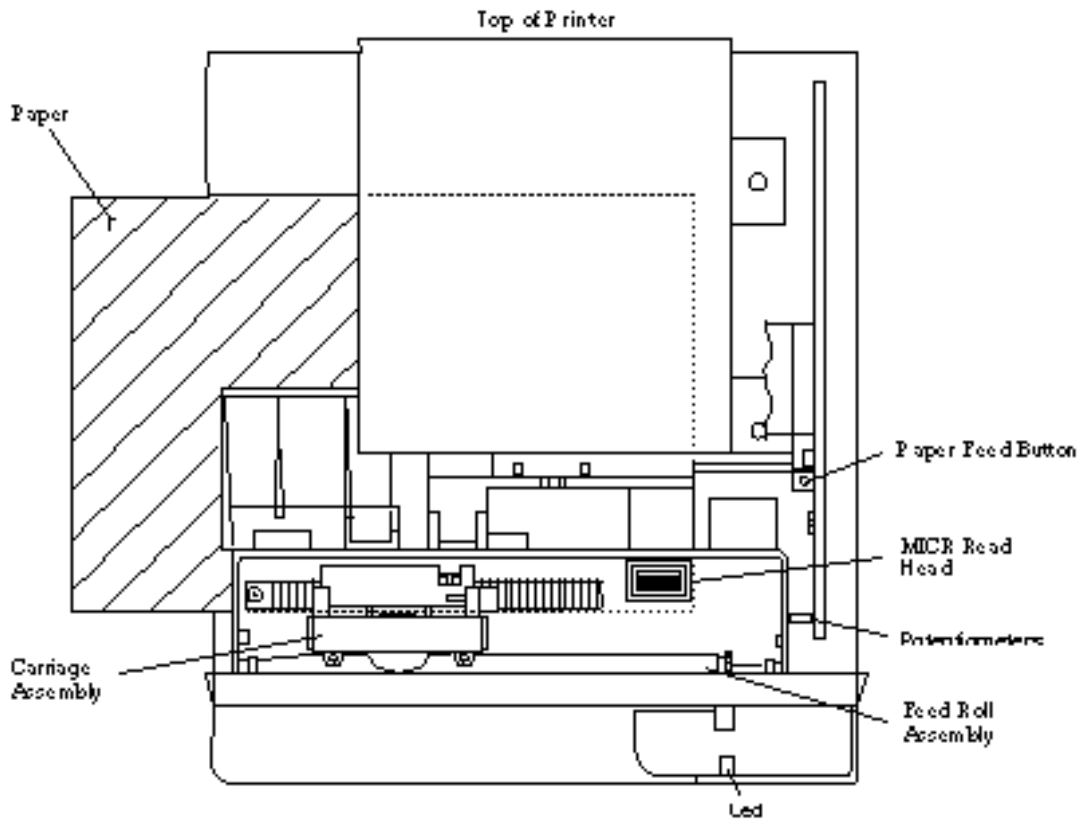
7. Press the Paper Feed button on the PC board to take a noise sample.

The green LED goes off then comes back on, the Paper Feed motor runs briefly, and the MICR read head raises and drops.

Either OK is printed on the receipt (indicating the MICR Reader does not need to be adjusted), or characters are printed on the receipt. The number of characters is proportional to the unwanted noise.

8. If OK is printed on the receipt, go to number 7 in the next section, "Adjust the MICR Reader."
9. If characters are printed on the receipt, perform all the steps in the next section, "Adjust the MICR Reader."

Adjust the MICR Reader



The procedures to adjust the MICR Reader involve setting the DIP switches and adjusting the two MICR Reader potentiometers on the PC board. You will need an insulated flathead screwdriver with a four-inch long shaft and 1/8 inch flat tip.

Caution: Do not adjust the potentiometers if the green LED is not lit (indicating the switches are incorrectly set). Doing so causes an incorrect noise sample.

Note: You may need to perform the following steps several times to get the potentiometers adjusted for the least amount of noise.

1. Remove the front cover from the hinge arm assembly.

This will make it easier to perform the adjustment.

- a. Open the hinge arm assembly.
 - b. Remove the screws holding the front cover to the hinge arm assembly.
 - c. Unsnap the front cover from the hinge arm assembly.
 - d. Close the hinge arm assembly to finish the adjustment.
2. Insert a blank slip into the slip station from the left side so that it covers the MICR read head, but does not come into contact with the feed rolls.

Be sure that the slip covers the MICR read head and stays in position.

3. Set both potentiometers (on the PC board) to mid range using a screwdriver.
4. Adjust the lower potentiometer (R9) on the PC board either direction.

The green LED should be on before you adjust the potentiometer.

5. Press the Paper Feed button on the PC board to take a noise sample.

Repeat steps 3 and 4 until the lowest number of characters is printed. You may need to adjust the potentiometer both directions to get the best setting.

If OK is printed on the receipt, go to number 7.

6. Adjust the upper potentiometer (R8) on the PC board either direction.

The green LED should be on before you adjust the potentiometer.

7. Press the Paper Feed button on the PC board to take a noise sample.

Repeat steps 5 and 6 until the lowest number of characters is printed. Adjust the potentiometer both directions to get the best setting. When OK is printed, the noise is low enough for the MICR to operate successfully.

8. Press the On Line button to take the printer off-line.
9. Set the DIP switches back to the settings for normal operation (on-line mode).

See "Switch Settings" in the "Communication" chapter for the settings.

10. Reattach the front cover.
11. Close the front cover and press the On Line button to put the printer on-line.

Verifying Read of MICR Characters

This test reads the characters on a check and prints a Hex dump of the characters on the receipt. It is run during normal operation (on-line mode).

Caution: The DIP switches are set at the factory to predetermined settings and should generally not be changed. If you must change the settings do so carefully to avoid changing other functions.

- 1. Press the On Line button to take the printer off-line.
- 2. Set the DIP switches to the settings in the table.

Switch 1 must be set to Off. Switch 8: On = knife, Off = non-knife

Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6	Switch 7
Off	On	Off	Off	Off	Off	On

- 3. Close the front cover and press the On Line button to put the printer on-line.
- 4. Insert a check into the slip station.

The printer waits until a check is inserted. When a check is inserted and detected, the platen closes and the characters are read by the MICR reader. The decoded data is printed to the receipt, the platen is opened, and the test is re-started.

If the MICR reader misreads the characters, question marks “?” are printed on the receipt. If the MICR reader is unable to read any characters, “NO MICR CHARACTERS” is printed on the receipt.

- 5. Press the On Line button to take the printer off-line and open the front cover.
- 6. Set the DIP switches back to the settings for normal operation (on-line mode).

See “Switch Settings” in the “Communication” chapter for the settings.

- 7. Close the front cover and press the On Line button to put the printer on-line.

Running the Data Scope Mode

This test prints a Hex dump of all data sent to the printer: “1” prints as Hex 31, “A” as Hex 41 and so on. This helps troubleshoot communication problems, and runs during a host application (after being enabled in Level 1 Diagnostics).

Enter the Data Scope Mode

Caution: The DIP switches are set at the factory to predetermined settings and should generally not be changed. If you must change the settings do so carefully to avoid changing other functions. Run the print test to see if the Data Scope Mode is on or off. See “Print Test” later in this chapter.

1. Open the front cover and set the DIP switches to the following settings:

Switch 7 is always Off. Switch 8: On = knife, Off = non-knife

Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6
On	Off	Off	On	Off	On

2. Close the front cover and press the On Line button to take the printer off-line.

The green LED flashes when the printer cycles.

3. Set the DIP switches back to the settings for normal operation (on-line mode).

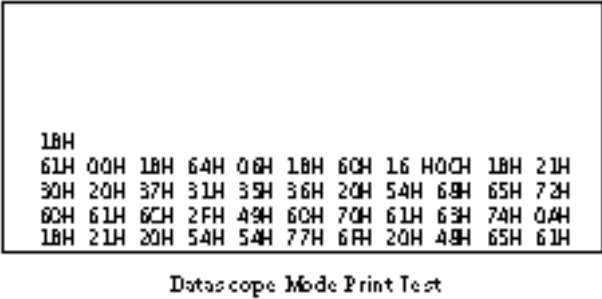
See “Switch Settings” in the “Communication” chapter for the settings.

4. Close the front cover and press the On Line button to put the printer on-line.

The green LED flashes when the printer cycles.

5. Run a transaction from the host system.

All commands and data sent from the host system will be printed as Hex characters as shown in the following illustration.



Exit the Data Scope Mode

- 1. Open the front cover and set the DIP switches to the following settings:

Switch 7 is always Off. Switch 8: On = knife, Off = non-knife

Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6
On	Off	Off	On	Off	Off

- 2. Close the front cover and press the On Line button to take the printer off-line.
The green LED flashes when the printer cycles.
- 3. Set the DIP switches back to the settings for normal operation (on-line mode).
See “Switch Settings” in the “Communication” chapter for the settings.
- 4. Close the front cover and press the On Line button to put the printer on-line.
The green LED flashes when the printer cycles.
The printer will now communicate normally with the host system.

Testing the Slip and Receipt Stations

These functions allow you to select various tests to check slip and receipt printing. It is the only way to run the print test on the slip station. You can also run a print test on the receipt station without changing the DIP switches by following the procedures in "Print Test" later in this chapter.

Print Sample Check Via Feed Button

This test prints a sample check. Because blank checks are not all laid out the same, the information may not line up perfectly on the blank check you use.

Caution: The DIP switches are set at the factory to predetermined settings and should generally not be changed. If you must change the settings do so carefully to avoid changing other functions.

1. Open the front cover and set the DIP switches to the following settings:

Switch 7 is always Off. Switch 8: On = knife, Off = non-knife

Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6
On	Off	Off	Off	Off	Off

2. Close the front cover and press the On Line button.
3. Insert the blank check.

The green LED comes on indicating the check is in the proper position.

4. Press the Paper Feed button to print the sample check.

The check is fed back out.

5. Press the Paper Feed button to open the platen so you can remove the check.
6. Repeat steps 3-5 to print another sample check, or go to step 7 to stop.
7. Set the DIP switches back to the settings for normal operation (on-line mode).

See "Switch Settings" in the "Communication" chapter for the settings.

8. Close the front cover and press the On Line button.

The green LED flashes when the printer cycles.

Print a Continuous Slip

This test prints several lines of data that show the settings for the functions set in level 1 diagnostics, then prints the character sets in all the possible variations as long as slips are fed into the printer. This is similar to the information printed on the receipt during the receipt test. See the sample printout at the end of this chapter.

Caution: The DIP switches are set at the factory to predetermined settings and should generally not be changed. If you must change the settings do so carefully to avoid changing other functions.

- 1. Open the front cover and set the DIP switches to the following settings:

Switch 7 is always Off. Switch 8: On = knife, Off = non-knife

Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6
On	Off	Off	Off	Off	On

- 2. Close the front cover and press the On Line button.
- 3. Insert a long piece of paper that is at least five inches wide into the slip area.
The green LED comes on indicating the paper is in the proper position.
- 4. Press the Paper Feed button to print on the paper.
The printer stops when the end of the paper is fed past the front sensor.
- 5. Repeat steps 3 and 4 to continue the test, or go to step 6 to stop.
- 6. Set the DIP switches back to the settings for normal operation (on-line mode).
See “Switch Settings” in the “Communication” chapter for the settings.
- 7. Close the front cover and press the On Line button.
The green LED flashes when the printer cycles.

Print a Sample Receipt (Single or Continuous)

These tests print sample receipts, either once or continuously.

Caution: The DIP switches are set at the factory to predetermined settings and should generally not be changed. If you must change the settings do so carefully to avoid changing other functions.

1. Open the front cover and set the DIP switches to the settings in the table for the test you want to run.

Switch 7 is always Off. Switch 8: On = knife, Off = non-knife

Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6	Option
On	Off	Off	Off	On	Off	Sample Receipt Via Feed Button
On	Off	Off	Off	On	On	Continuous Sample Receipt

2. Close the front cover and press the On Line button.

The printer automatically begins printing the sample receipt. If the Sample Receipt Via Feed Button option is selected, the printer will stop printing after all the character sets have been printed.

3. Press the Paper Feed button to repeat the test.
4. Press the On Line button to stop the test.
5. Set the DIP switches back to the settings for normal operation (on-line mode).

See “Switch Settings” in the “Communication” chapter for the settings.

6. Close the front cover and press the On Line button.

The green LED flashes when the printer cycles.

Level 2 Diagnostics

Level 2 diagnostics run during normal printer operation. When the following conditions occur, the printer automatically turns off the appropriate motor, disables printing to prevent damage, and turns on the red LED (flashes the red LED if the receipt printhead is too hot or the voltages are out of range):

- Receipt paper out
- Receipt cover open
- Front cover (cassette door) open
- Receipt knife unable to home
- Slip carriage motor jam
- Receipt printhead too hot or voltages out of range (red LED flashes)

See “Solving Problems” earlier in this book for more information about other conditions that may occur and how to correct them.

Level 3 Diagnostics

Level 3 diagnostics keeps track of the following tallies and prints them on the receipt during the receipt test. See “Sample Print Test” later in this chapter.

- Thermal print lines printed
- Number of knife cuts
- Number of hours printer is on.

Print Test

Test the receipt station using the simple tests described in this section. To further test the receipt station or to test the slip station, run the level 1 diagnostic tests described in “Level 1 Diagnostics” earlier in this chapter.

The tests described here print various settings which can be used to check the printer's configuration. The settings are listed in “Level 1 Diagnostics.” The tests also print all variations of the character sets with a partial cut between each variation. See the sample at the end of this chapter. The sample does not show the character sets. The tests end with a partial cut, then begin again. Several feet of paper can be used to print one pass of the test.

Running the Print Test by Power Cycling the Printer

1. Press and hold down the Paper Feed button on the top panel.
2. Press the On Line button.
3. Let go of the Paper Feed button once the printing begins.

The printer begins printing the data and character sets (see the sample).

4. To stop the test, press the Paper Feed button.

The printer is ready to receive and print data from the host system.

Running the Print Test by Opening and Closing the Cover

1. Open the receipt cover by pulling up on the front left side of the cover.

The LED (red) comes on indicating the receipt cover is open and that the printer cannot receive or print data (not that the paper is out).

2. Press and hold down the Paper Feed button while closing the receipt cover.
3. Let go of the Paper Feed button once the printing begins.

The printer begins printing the data and character sets (see the sample).

4. To stop the test, press the Paper Feed button.

The printer is ready to receive and print data from the host system.

Sample Print Test

```

7156 Thermal/Impact

Firmware CRC is 8D8B

      Switches
    1 2 3 4 5 6 7 8
  OFF OFF OFF OFF ON  OFF OFF ON

      Straps
RS232 comm      Knife
MICR DC offset is 7C
MICR parsing is  FF

Non-volatile memory
RS232 setup
-printL ? for error
-4K data buffer

Thermal Head Setting E
Partial Cut Setting 3
Datascopes Mode OFF
Print and feed w/ <CR>

thermal lines3,370,017
knife cuts 251,000
hours on 557

```

Communication

Communication Overview

In order for a receipt or slip to be printed, a program must be in place that translates the data from the host system into a language that the printer can understand. This program must tell the printer exactly how to print each character. This chapter describes how to create such a program or modify an existing one.

Interface

In order for the printer to communicate with the host, a communication link must be set up. The 7156 supports the industry standard RS-232C communication interface. This interface has a protocol associated with it that the host system must understand and adhere to.

Only when the interface parameters are matched and the proper protocol is used will the host and the printer be able to communicate. See the section, "RS-232C Interface" on the next page for a description of the protocol associated with the RS-232C interface.

Sending Commands

Once the communication link is established, commands can be sent to the printer. This section describes how to send commands to the printer using DOS and BASIC. This section does not take into account the necessary protocol, but is meant as a general introduction to how the printer functions.

Using DOS to Send Commands

One way of getting commands to the printer is to send them directly from DOS. For example, the command

```
COPY CON: COM1:
```

sets the computer up such that the Hex code corresponding to any key that was pressed would be sent to the RS-232C communication port COM1 when the COPY mode is exited. If the printer is connected to COM1, then the data will go to the printer.

Exit the COPY mode by typing

```
CTRL Z
```

and then pressing the ENTER key. Once the computer knows to direct data from any print command to the proper port, commands can be sent from any software program.

Using BASIC to Send Commands

In BASIC, printer commands are sent as a string of characters preceded by the LPRINT command. For example,

```
LPRINT CHR$(&H0A)
```

sends the hexadecimal number 0A to the printer, which causes the printer to print the contents of its print buffer. Previously sent commands tell the printer exactly how this data should appear on the paper. For example,

```
LPRINT CHR$(&H12); "ABC"; CHR$(&H0A)
```

sends the Hex numbers 12 41 42 43 0A to the printer. This causes the printer to set itself to double wide mode (12), load the print buffer with "ABC" (41 42 43), and finally, print (0A). Again, the communication link that the BASIC program outputs to must be matched to that of the printer.

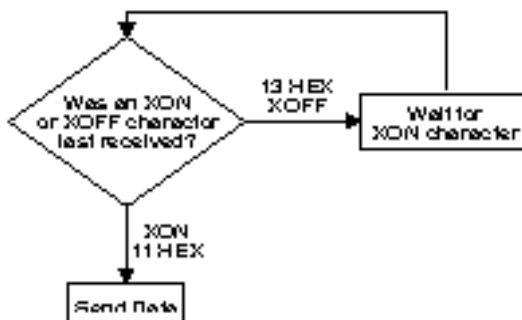
RS-232C Interface

The RS-232C interface uses either XON / XOFF or DTR / DSR protocol. For XON / XOFF, a particular character is sent back and forth between the host and the printer to regulate the communication. For DTR / DSR, changes in the DTR / DSR signal coordinate the information flow.

The RS-232C version of the 7156 offers the standard options which are selected with the DIP switches. See "Switch Settings" later in this chapter.

XON/XOFF Protocol

The XON / XOFF characters coordinate the information transfer between the printer and the host system. The printer sends an XON character when it is ready to receive data and it sends an XOFF character when it cannot accept any more data. The software on the host system must monitor the communication link as shown in the following flowchart in order to send data at the appropriate times.

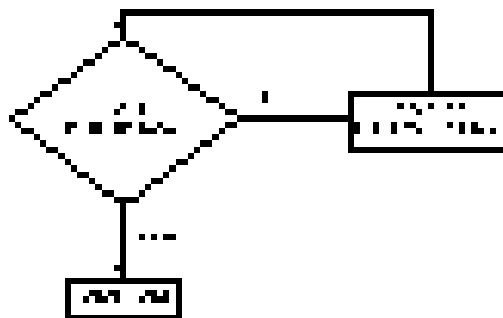


XON character = Hex 11.

XOFF character = Hex 13.

DTR/DSR Protocol

The DTR signal is used to control data transmission to the printer. It is driven low when the printer is ready to receive data and driven high when it cannot accept any more data. Data is transmitted from the printer after it confirms that the DSR signal is low.

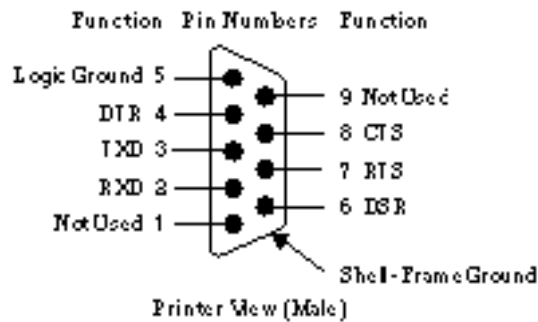


RS-232C Technical Specifications

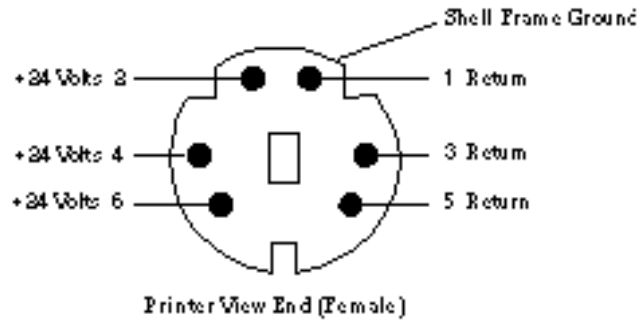
This section describes the pin settings for the connectors and the RS-232C interface parameters. The RS-232C parameters are selected by setting the DIP switches on the printed circuit board. See the illustration on page 16 for the position of the DIP switches. The RS-232C parameters must match those of the host.

Connectors

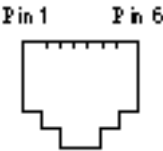
The following illustration shows the RS-232C communication connector and pin assignments. The connector is a 9-pin male D-shell connector and is located in the hollow cavity under the printer at the rear.



The 7156 is always remotely powered. The following illustration shows the power cable connector and pin assignments. The power cable connector is a 6-pin mini DIN plug and is located in the hollow cavity under the printer at the rear.



The following illustration shows the pin out designation for the cash drawer connectors. The following table provides the pinout assignments for cash drawers one and two. The cash drawer connectors are located at the rear of the printer.

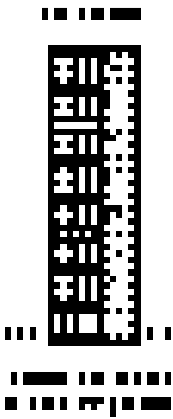


Pin Number	Cash Drawer 1 Connector	Cash Drawer 2 Connector
1	Frame Ground	Frame Ground
2	Drawer 1 Solenoid	Drawer 2 Solenoid (Optional by jumper: JPR4)
3	Drawer 1 Status Switch	Drawer 2 Status Switch
4	+24 Volts (to Solenoid +)	+24 Volts (to Solenoid +)
5	Drawer 2 Solenoid (Optional by jumper: JPR3)	Drawer 2 Solenoid
6	Ground (Status Switch Return)	Ground (Status Switch Return)

Switch Settings

The DIP switches are located on the PC board behind the front cover as shown in the illustration on page 16. They are used to set the RS-232C parameters as shown in the following illustration and table. These parameters must match those of the host system in order for the host system and the printer to communicate.

Note: The switches can also be used for setting other functions and tests. Be careful when setting the switches for the RS-232C settings that you do not accidentally change the settings for the other functions and tests. See “Level 1 Diagnostics” earlier in this book for more information.



Use a paper clip or other pointed object to set the switches.

1. Open the front cover.
2. Set the switches to the desired settings shown in the table.

Switch 1 must be set to Off when setting switches for the RS-232C settings.

This puts the printer in the on-line mode where it can communicate with the host system.

Caution: Do not set switch 1 to On. Setting switch 1 to On puts the printer in level 1 diagnostics (setup mode) where other functions and tests can be changed.

3. Close the cover .

DIP Switch Settings for RS-232C Parameters

Switch	Settings		Description
1	OFF		On-line Mode, Use to set RS-232C options (default)
2	OFF		DTR / DSR Protocol (default)
	ON		XON / XOFF Protocol
3	OFF		Without Parity (default)
	ON		With Parity
4	OFF		Odd Parity
	ON		Even Parity
5, 6	5	6	
	OFF	OFF	19,200 Baud
	ON	OFF	9600 Baud (default)
	OFF	ON	4800 Baud
	ON	ON	1200 Baud

Setting Extra RS-232C Options

The following extra options are available for the RS-232C Interface:

- Data errors
 - Print “?” for data errors (default)
 - Ignore data errors
- Data buffer
 - Set data buffer = 4K bytes (default)
 - Set data buffer = one line

These options are set with the DIP switches in level 1 diagnostics. See “Level 1 Diagnostics” earlier in this book for instructions on setting these options.

Commands

The commands control all operations and functions of the 7156 printer, from selecting the size and placement of characters and graphics on the receipt or slip to feeding and cutting the paper.

The 7156 commands emulate the NCR 7150™ Multifunction printer, the Epson TM-T80™ Thermal printer, and the Epson TM-930™ Thermal printer. You may select from any of the commands to program a host system to communicate with the 7156 printer.

Some commands listed and described here are not implemented in the 7156 (they are identified as not implemented). If received, they are ignored and not sent to the print buffer as data. Non-legal commands are sent to the print buffer as data.

Command List

This section groups the commands according to the following categories:

- Printer Function Commands
- Print Characteristics Commands
- Station Select Commands
- Graphics Commands
- Printer Status Commands
- Real Time Commands
- Bar Code Commands
- MICR Reader Commands

Within each group, the commands are listed in numerical order of their Hex codes. The page number refers to where a complete description of each command is given in the “Command Descriptions” section which begins on page 77.

Printer Function Commands

These commands control the following basic printer functions and are listed in numerical order of their Hex codes:

- Printing
- Feeding the paper
- Moving the printhead (slip station)
- Resetting the printer
- Cutting the paper

Printer Function Commands

Hex Code	Command	Page
09	Horizontal Tab	77
0A	Line Feed	77
0C	Print and Eject Slip	78
0D	Carriage Return	78
10	Clear Printer	78
11	Close Form (Slip Station)	79
14 <i>n</i>	Feed <i>n</i> Print Lines	79
15 <i>n</i>	Feed <i>n</i> Dot Rows	79
16 <i>n</i>	Add <i>n</i> Extra Dot Rows	80
17	Print	81
18	Open Form (Slip Station)	81
19	Full Knife Cut	81
1B 69		
1A	Partial Knife Cut	81
1B 6D		
1B 07	Generate Tone	82
1B 14 <i>n</i>	Set Column	82
1B 20 <i>n</i>	Set Character Right-Side Spacing (Not Implemented)	82
1B 24 etc.	Set Absolute Starting Position	83
1B 32	Set Line Spacing to 1/6 Inch	83
1B 33 <i>n</i>	Set Line Spacing to <i>n</i> Minimum Units	84
1B 3C	Return Home (Slip Station)	84

1B 3D <i>n</i>	Select Device (Not Implemented)	84
1B 40	Initialize Printer	85
1B 43 <i>n</i>	Set Slip Eject Length	85
1B 44 etc.	Set Horizontal Tab Positions	85
1B 4A <i>n</i>	Print and Feed <i>n</i> Minimum Units	86
1B 4B <i>n</i>	Print and Reverse Feed <i>n</i> Minimum Units	86
1B 55 <i>n</i>	Set or Cancel Unidirectional Print (Slip Station)	86
1B 5C etc.	Set Relative Starting Position	87
1B 61 <i>n</i>	Align Positions (Receipt Station)	88
1B 63 33 <i>n</i>	Select Paper-End Signal Output	88
1B 63 34 <i>n</i>	Select Sensors to Stop Printing	88
1B 63 35 <i>n</i>	Enable or Disable Panel Switch (Paper Feed Button)	88
1B 63 36 <i>n</i>	Enable or Disable On-Line Button	89
1B 64 <i>n</i>	Print and Feed <i>n</i> Lines	89
1B 65 <i>n</i>	Print and Reverse Feed <i>n</i> Lines	89
1B 66 <i>m n</i>	Set Slip Waiting Time	89
1B 6A <i>k</i>	Read from Non-Volatile Memory	90
1B 70 etc.	Generate Pulse to Open Cash Drawer	90
1B 73 <i>n</i> etc.	Write to Non-Volatile Memory	90
1B 7A <i>n</i>	Set or Cancel Parallel Journal Printing	91
1D 14 <i>n</i>	Reverse Feed <i>n</i> Lines (Slip Station)	91
1D 15 <i>n</i>	Reverse Feed <i>n</i> Dots (Slip Station)	91
1E	Journal Tab (ignored if 1B 63 30 used to select station)	92

This command can also be interpreted as Select Receipt Station (if 1C used to select slip station)

For more information, see the descriptions for the Journal Tab command and the Select Receipt Station command in the next section, "Command Descriptions."

Print Characteristics Commands

These commands control what the printed information looks like and are listed in numerical order of their Hex codes.

Print Characteristics Commands

Hex Code	Command	Page
12	Double-Wide Characters	92
13	Single-Wide Characters	93
1B 12	Rotated Print	93
1B 16 <i>n</i>	Select Pitch (Column Width)	93
1B 21 <i>m</i>	Set Print Mode	94
1B 25 <i>n</i>	Select Character Set	94
1B 26 etc.	Define User-Defined Character Set (Receipt & Slip Stations)	95
1B 3A 0 0 0	Copy Character Set From ROM to RAM	97
1B 47	Enable Double Strike (Slip Station)	97
1B 48	Disable Double Strike (Slip Station)	98
1B 52 <i>n</i> 1B 74 <i>n</i>	Select Character Code Table	98
1B 56 <i>n</i>	Set or Cancel Rotated Print	98
1B 7B <i>n</i>	Set or Cancel Upside-Down Print	98

Station Select Commands

These commands control which station incoming data is printed on.

Station Select Commands

Hex Code	Command	Page
1B 63 30 <i>n</i>	Select Receipt or Slip for Printing, Slip for MICR Read	100
1B 63 31 <i>n</i>	Select Receipt or Slip for Setting Line Spacing	100
1C	Select Slip Station	100
1E	Select Receipt Station (if 1C used to select slip station)	101

This command can also be interpreted as Journal Tab (ignored if 1B 63 used to select station)

For more information, see the descriptions for the Journal Tab command and the Select Receipt Station command in the next section, "Command Descriptions."

Graphics Commands

These commands print graphics data and are listed in numerical order of their Hex codes.

Graphics Commands

Hex Code	Command	Page
1B 24 etc.	Set Absolute Starting Position	102
1B 2A <i>m</i> etc.	Set Bit Image Mode	103
1B 4C etc. 1B 59 etc.	Double-Density Graphics	105
1D 2A etc	Define Downloaded Bit Image (Receipt Station)	105
1D 2F <i>m</i>	Print Downloaded Bit Image (Receipt Station)	106

Printer Status Commands

These commands send printer status information to the host system and are listed in numerical order of their Hex codes.

Printer Status Commands

Hex Code	Command	Page
1B 75 0	Transmit Cash Drawer Status	107
1B 76	Transmit Printer Status	108

Real Time Commands

These commands correct difficulties with the original version of the 7156 RS-232C communication interface.

Real Time Commands

Hex Code	Command	Page
1D 04 <i>n</i>	Real Time Status Transmission, GS Sequence	111
10 04 <i>n</i>	Real Time Status Transmission, DLE Sequence	112
1D 03 <i>n</i>	Real Time Request to Printer, GS Sequence	116
10 05 <i>n</i>	Real Time Request to Printer, DLE Sequence	116
1D 05	Real Time Printer Status Transmission	118

Bar Code Commands

These commands print bar codes on the receipt station and are listed in numerical order of their Hex codes. HRI means Human Readable Interface.

Bar Code Commands

Hex Code	Command	Page
1D 48 <i>n</i>	Select Printing Position of HRI Characters (Receipt Station)	120
1D 66 <i>n</i>	Select Pitch of HRI Characters (Receipt Station—Not Implemented)	120
1D 68 <i>n</i>	Select Height of Bar Code (Receipt Station)	120
1D 6B <i>n</i> etc.	Print Bar Code (Receipt Station)	121
1D 6B 49 <i>n</i>	Print Code 128 Bar Code (Receipt Station)	122
1D 77 <i>n</i>	Select Horizontal Size of Bar Code (Receipt Station)	122

MICR Reader Commands

These commands control the Magnetic Ink Character Recognition (MICR) Reader, including how it parses the character strings on checks.

MICR Reader Commands

Hex Code	Command	Page
1B 77 01	Read MICR Data and Transmit	123
1B 77 50	Define Parsing Format, Save in NVRAM	123
1B 77 52	Reread MICR Data	123
1B 77 70	Define Parsing Format, Do Not Save Permanently	124

Command Descriptions

This section lists the commands with their Hex, Decimal, and ASCII codes. The commands are grouped according to the following categories:

- Printer Function Commands
- Print Characteristics Commands
- Station Select Commands
- Graphics Commands
- Printer Status Commands
- Bar Code Commands
- MICR Reader Commands

Printer Function Commands

These commands control the following basic printer functions:

- Printing
- Feeding the paper
- Moving the printhead (slip station)
- Resetting the printer
- Cutting the paper

Horizontal Tab

Moves the print position to the next horizontal tab position set by the command, **Set Horizontal Tab Positions (1B 44 n1 n2 . . . 00)**. The print position is reset to column one after each line.

Hex	Decimal	ASCII
09	9	HT

Line Feed

Prints one line from the buffer and feeds paper one line.

Hex	Decimal	ASCII
0A	10	LF

Print and Eject Slip

Prints data from the buffer to the slip station and reverses the slip out the front of the printer until it clears the feed roller. The command is ignored if the receipt station is the current station. Upon completion, the receipt station is assigned as the current station.

Hex	Decimal	ASCII
0C	12	FF

Carriage Return

Prints one line from the buffer and feeds paper one line. The printer can be set through the DIP switches to ignore or use this command. Some applications expect the command to be ignored while others use it as a print command. See “Ignoring/Using the Carriage Return” in the “Diagnostics” chapter earlier in this book.

Hex	Decimal	ASCII
0D	13	CR

Clear Printer

Clears the print line buffer without printing and sets the following configuration:

- Receipt station: selected
- Line Spacing, Pitch (Print Mode), User-Defined Character Sets: maintained at current selections (RAM is not affected)
- Normal mode: Single-Wide, Single-High, Non-Rotated, and Left-Aligned
- Printing position: column one
- Error status: clears a fault condition
- Slip platen: opened
- Slip printhead: homed
- Printer: restarted
- Knife: homed

Hex	Decimal	ASCII
10	16	DLE

Close Form (Slip Station)

Closes the feed roller and platen (forms compensation arm assembly) and retracts the forms arm stop. If the printer is reset or the **Clear (10)** is received, the feed roller and platen are opened.

Hex	Decimal	ASCII
11	17	DC1

Feed *n* Print Lines

Feeds paper *n* lines at the current line height without printing.

Hex	Decimal	ASCII	Value of <i>n</i>
14 <i>n</i>	20 <i>n</i>	DC4 <i>n</i>	0-255

Feed *n* Dot Rows

Feeds paper *n* dot rows without printing.

Hex	Decimal	ASCII	Value of <i>n</i>	Receipt	Slip
15 <i>n</i>	21 <i>n</i>	NAK <i>n</i>	0-255	<i>n</i> / 152 inch	<i>n</i> / 72 inch

Add *n* Extra Dot Rows

Adds *n* extra dot rows to the character height to increase space between print lines or decrease number of lines per inch.

Hex	Decimal	ASCII	Value of <i>n</i>	Receipt	Slip
16 <i>n</i>	22 <i>n</i>	SYN <i>n</i>	0-12	<i>n</i> / 152 inch	<i>n</i> / 72 inch
				Default = 2	Default = 3

The following table shows the relationship between the number of lines per inch and each extra dot row added for both the receipt and slip stations:

Receipt Station			Slip Station		
Extra Rows	Lines Per Inch	Dot Rows	Extra Rows	Lines Per Inch	Dot Rows
0	8.5	18	0	10.3	7
1	8.0	19	1	9.0	8
2	7.6	20	2	8.0	9
3	7.2	21	3	7.2	10
4	7.0	22	4	6.5	11
5	6.6	23	5	6.0	12
6	6.3	24	6	5.5	13
7	6.1	25	7	5.1	14
8	5.9	26	8	4.8	15
9	5.6	27	9	4.5	16
10	5.4	28	10	4.2	17
11	5.2	29	11	4.0	18
12	5.1	30	12	3.8	19

Print

Prints one line from the buffer and feeds paper one line.

Hex	Decimal	ASCII
17	23	ETB

Open Form (Slip Station)

Opens the feed roller and platen (forms compensation arm assembly) so that a form may be inserted (default position).

Hex	Decimal	ASCII
18	24	CAN

Full Knife Cut

This command is implemented the same as **Partial Knife Cut (1A, 1B 6D)**. Use either Hex 19 or Hex 1B 69.

Hex	Decimal	ASCII
19	25	EM
1B 69	27 105	ESC i

Partial Knife Cut

Partially cuts the receipt. The length of the cut can be changed through the DIP switches. See "Setting Partial Cut Distance" on page 43. The default setting leaves .20 inches (5 mm) of paper on the left edge. The cut edge is 108 dot rows or .71 inches (18 mm) above the receipt print line. The command is valid only at the beginning of a line.

Use either Hex 1A or Hex 1B 6D.

Hex	Decimal	ASCII
1A	26	SUB
1B 6D	27 109	ESC m

Generate Tone

Activates a short tone.

Hex	Decimal	ASCII
1B 07	27 7	ESC BEL

Set Column

Prints the first character of the next print line in column *n*. The command is not valid with Single or Double Density graphics.

Hex	Decimal	ASCII	Value of <i>n</i> Receipt (Pitch)	Value of <i>n</i> Slip (Pitch)
1B 14 <i>n</i>	27 20 <i>n</i>	ESC DC4 <i>n</i>	1-44 (Standard) 1-56 (Compressed)	1-66 (Standard) 1-80 (Compressed)
<i>n</i> resets to one after each line is printed.				

Set Character Right-Side Spacing

This command is not implemented and is ignored if received.

Hex	Decimal	ASCII
1B 20 <i>n</i>	27 32 <i>n</i>	ESC (SPACE) <i>n</i>

Set Absolute Starting Position

Sets the print starting position to the specified number of dots (up to the right margin) from the beginning of the line. The print starting position is reset to the first column after each line.

Hex	Decimal	ASCII
1B 24 <i>n1 n2</i>	27 36 <i>n1 n2</i>	ESC \$ <i>n1 n2</i>
<i>n</i> = Number of dots to be moved from the beginning of the line		
<i>n1</i> = Remainder after dividing <i>n</i> by 256		
<i>n2</i> = Integer after dividing <i>n</i> by 256		

The values for *n1* and *n2* are two bytes in low byte, high byte word orientation.

Determine the value of *n* by multiplying the column for the absolute starting position by 10 (standard pitch) or 8 (compressed pitch). The example shows how to calculate column 29 (10 dots per column) as the absolute starting position.

$$\begin{aligned}
 28 \times 10 &= 280 \text{ dots (beginning of column 29)} \\
 280 / 256 &= 1, \text{ remainder of } 24 \\
 n1 &= 24 & n2 &= 1
 \end{aligned}$$

Note: This command is also used in the graphics mode to emulate the Epson LQ-950™ dot matrix printer. See “Graphics Commands” later in this chapter for more information.

Set Line Spacing to 1/6 Inch

Sets the line spacing to 1 / 6 of an inch (4.25 mm) or 6 lines / inch on the selected station. The command is not affected by the **Print (17)** command. At initialization the receipt is reset to .13 inch (7.6 lines / inch, 2 extra dot rows); the slip is reset to .14 inch (7.2 lines / inch, 3 extra dot rows).

Hex	Decimal	ASCII	Default: Receipt	Default: Slip
1B 32	27 50	ESC 2	.13 inch (7.6 lines per inch, 2 extra dot rows)	.14 inch (7.2 lines per inch, 3 extra dot rows)

Set Line Spacing to *n* Minimum Units

Sets the line spacing on the selected station:

- Receipt station: $n/360$ of an inch
- Slip station: $n/144$ of an inch (on some models, the command may not affect the slip station)

The minimum line spacing is 8.5 lines per inch. The line spacing equals the character height when n is too small.

Hex	Decimal	ASCII	Value of <i>n</i>	Default	Default: Slip
1B 33 <i>n</i>	27 51 <i>n</i>	ESC 3 <i>n</i>	0-255	.13 inch (7.6 lines per inch, 2 extra dot rows)	.14 inch (7.2 lines per inch, 3 extra dot rows)

Return Home (Slip Station)

Moves the impact printhead to the home position (beginning of line on the left side). If the printhead is already in the home position, it is not re-homed.

As the 7156 is able to detect carriage motor jams, the printhead does not need to be homed after each receipt. The Epson TM-930™ homes the printhead after each receipt because it is unable to detect carriage motor jams.

Hex	Decimal	ASCII
1B 3C	27 60	ESC <

Select Device

This command is not implemented and is ignored if received.

Hex	Decimal	ASCII	Value of <i>n</i>	Default
1B 3D <i>n</i>	27 61 <i>n</i>	ESC = <i>n</i>	0 (bit 0), printer not selected 1 (bit 0), printer selected	1

Initialize Printer

Clears the buffer and resets printer to the default settings (startup configuration).

- Receipt station is selected
- Normal mode: Single-Wide, Single-High, Non-Rotated, and Left-Aligned (printing position set to column one)
- Extra Dot Rows is set to 2 (receipt), and 3 (slip)
- User-defined characters or logo graphics (from RAM) are cleared
- Character Set is set to Code Page 437 (default)
- Character Pitch is reset to 15.2 CPI (receipt default), 13.9 CPI (slip default)
- Column Width is reset to 44 characters (receipt) and 66 characters (slip)

Hex	Decimal	ASCII
1B 40	27 64	ESC @

Set Slip Eject Length

This command is not implemented and is ignored if received.

Hex	Decimal	ASCII
1B 43 <i>n</i>	27 67 <i>n</i>	ESC C <i>n</i>

Set Horizontal Tab Positions

Sets up to 32 horizontal tab positions *n* columns from column one, but does not move the print position. See the **Horizontal Tab (09)** command.

Set the tab positions in ascending order and put Hex 00 at the end. Hex 1B 44 00 (number of tabs not specified) clears all tab positions. The tab positions remain unchanged if the character widths are changed after the tabs are set. The default tab positions are at intervals of eight characters (column 9, column 17, column 25, and so forth) for normal print.

Hex	Decimal	ASCII	Value of <i>n</i>
1B 44 <i>n</i> 1 <i>n</i> 2...00	27 68 <i>n</i> 1 <i>n</i> 2...00	ESC D <i>n</i> 1 <i>n</i> 2...00	Column number minus one*

n is always less than or equal to the current selected column width.

Print and Feed *n* Minimum Units

Prints one line from the buffer and feeds the paper $n/360$ of an inch on the receipt station or $n/144$ of an inch on the slip station.

On the receipt station, the line height equals the character height when n is too small. This does not apply to the slip station. Use $n = 0$ to print a line without feeding the paper. This allows the printer to print on the last line of the slip (at .59 inches from the trailing edge) and still retain the slip in the feed rollers for reverse feeding the paper back out of the slip station.

Hex	Decimal	ASCII	Value of <i>n</i>
1B 4A <i>n</i>	27 74 <i>n</i>	ESC J <i>n</i>	0-255

n is always less than or equal to the current selected column width.

Print and Reverse Feed *n* Minimum Units (Slip Station)

Prints one line from the buffer and reverse feeds the paper $n/144$ of an inch on the slip station. The receipt station cannot be reverse fed. If the receipt station is selected, the paper is fed forward $n/360$ of an inch.

Hex	Decimal	ASCII	Value of <i>n</i>
1B 4B <i>n</i>	27 75 <i>n</i>	ESC K <i>n</i>	0-255

Set or Cancel Unidirectional Print (Slip Station)

Toggles between unidirectional and bidirectional printing on the slip station. Unidirectional printing reduces column alignment tolerances and provides higher quality printing. Printing is normally bidirectional because of the faster speed.

Hex	Decimal	ASCII	Value of <i>n</i>	Default
1B 55 <i>n</i>	27 85 <i>n</i>	ESC U <i>n</i>	0 = select bidirectional	0
			1 = select unidirectional	

Set Relative Starting Position

Moves the print starting position the specified number of dots either right (up to the right margin) or left (up to the left margin) of the current position.

The print starting position is reset to the first column after each line.

Hex	Decimal	ASCII	Value of <i>n</i>
1B 5C <i>n1 n2</i>	27 92 <i>n1 n2</i>	ESC \ <i>n1 n2</i>	See Examples Below

To Move the Relative Starting Position Right of the Current Position

n = Number of dots to be moved right of the current position

n1 = Remainder after dividing *n* by 256

n2 = Integer after dividing *n* by 256

The values for *n1* and *n2* are two bytes in low byte, high byte word orientation.

Determine the value of *n* by multiplying the number of columns to move right of the current position by 10 (standard pitch) or 8 (compressed pitch). The example shows how to set the relative position two columns in standard pitch (10 dots per column) to the right of the current position.

$2 \times 10 = 20$ dots (two columns to be moved right of the current position)

$20 / 256 = 0$, remainder of 20

n1 = 20 *n2* = 0

To Move the Relative Starting Position Left of the Current Position

n = Number of dots to be moved left of the current position

n1 = Remainder after dividing (65,536-*n*) by 256

n2 = Integer after dividing (65,536-*n*) by 256

The values for *n1* and *n2* are two bytes in low byte, high byte word orientation.

Determine the value of *n* by multiplying the number of columns to move left of the current position by 10 (standard pitch) or 8 (compressed pitch). The example shows how to set the relative position two columns in standard pitch (10 dots per column) to the left of the current position.

Align Positions (Receipt Station)

Specifies the alignment of the characters, graphics, logos, and bar codes on the receipt station according to the table below. The command is valid only when input at the beginning of a line.

Hex	Decimal	ASCII	Value of <i>n</i>	Default
1B 61 <i>n</i>	27 97 <i>n</i>	ESC a <i>n</i>	0 = Left Aligned 1 = Center Aligned 2 = Right Aligned	0

Select Paper-End Signal Output

This command is not implemented and is ignored if received. The four bytes of this command are used for backward compatibility to Epson TM-930™ applications. The RS-232C interface can accept multiple status bits, unlike the parallel interface (used in the Epson TM-930™).

Hex	Decimal	ASCII
1B 63 33 <i>n</i>	27 99 51 <i>n</i>	ESC c 3 <i>n</i>

Select Sensors to Stop Printing

Determines which sensor stops printing on the respective station. The command does not affect the paper out sensor on the receipt station which automatically stops the printer when the paper runs out.

Hex	Decimal	ASCII	Bit (of <i>n</i>)
1B 63 34 <i>n</i>	27 99 52 <i>n</i>	ESC c 4 <i>n</i>	0, 1 = Stop Receipt on Receipt Low 4 = Stop Slip if Trailing Edge Uncovered 5 = Stop Slip if Leading Edge Uncovered

Enable or Disable Panel Switch (Paper Feed Button)

Toggles the paper feed button on and off. Only the lowest bit is used to toggle the paper feed button. If the last bit is 0, the paper feed button is enabled. If the last bit is 1, the paper feed button is disabled. Functions that require using the paper feed button cannot be used when it is disabled with this command.

Hex	Decimal	ASCII	Value of <i>n</i>	Default
1B 63 35 <i>n</i>	27 99 53 <i>n</i>	ESC c 5 <i>n</i>	0-255	0

Enable or Disable On-Line Button

This command is not implemented and is ignored if received.

Hex	Decimal	ASCII
1B 63 36 <i>n</i>	27 99 54 <i>n</i>	ESC c 6 <i>n</i>

Print and Feed *n* Lines

Prints one line from the buffer and feeds paper *n* lines at the current line height.

Hex	Decimal	ASCII	Value of <i>n</i>
1B 64 <i>n</i>	27 100 <i>n</i>	ESC d <i>n</i>	0-255 (0 interpreted as 1 on the receipt station)

Print and Reverse Feed *n* Lines

Prints one line from the buffer and reverse feeds the paper *n* lines on the slip station. The receipt station cannot be reverse fed. If the receipt station is selected, the paper is fed forward *n* lines.

Hex	Decimal	ASCII	Value of <i>n</i>
1B 65 <i>n</i>	27 101 <i>n</i>	ESC e <i>n</i>	0-255

Set Slip Waiting Time

Sets the time (in *m* minutes) that the printer waits for a slip to be inserted into the slip station and the time (*n* x 0.1 seconds) for the printer to close the platen and start printing once the slip has been inserted. The printer reads that a slip is inserted when the leading edge and trailing edge sensors are covered. The LED on the slip table is lit (green) when both sensors are covered.

If a slip is not inserted in the time specified, the receipt station is selected for the next function. If *m* = 0, the printer waits forever for a slip to be inserted. The times set by this command are used only by the command, **Select Receipt or Slip for Printing, Slip for MICR Read (1B 63 30 *n*)**, with *n* set to 04.

Hex	Decimal	ASCII	Value of <i>m</i>	Value of <i>n</i>
1B 66 <i>m n</i>	27 102 <i>m n</i>	ESC f <i>m n</i>	0-255	0-255

Read from Non-Volatile Memory

Reads a two-byte word from location *k* in the history EEROM.

Hex	Decimal	ASCII	Value of <i>k</i>
1B 6A <i>k</i>	27 106 <i>k</i>	ESC j <i>k</i>	0-63

With LCSIO (RS-485), the printer returns the word in response to a subsequent poll. The word is be appended to the normal three-byte response as shown.

STA1	STA2	ADDR	6A	N1	N2
------	------	------	----	----	----

Generate Pulse to Open Cash Drawer

Outputs a pulse defined by *n1* and *n2* to open a cash drawer.

Hex	Decimal	ASCII	Value of <i>m</i>	Value of <i>n</i>
1B 70 <i>m n1 n2</i>	27 112 <i>m n1 n2</i>	ESC p <i>m n1 n2</i>	0 = Drawer 1 1 = Drawer 2	0-255

n1 = (Pulse Ontime)
n2 = (Pulse Offtime)
The pulse is measured as 2 ms. x *n* (1 or 2).

Write to Non-Volatile Memory

Writes two-byte word *n1:n2* to location *k* in history EEROM.

Hex	Decimal	ASCII	Value of <i>n</i>	Value of <i>n</i>
1B 73 <i>n1 n2 k</i>	27 115 <i>n1 n2 k</i>	ESC s <i>n1 n2 k</i>	<i>n1</i> = First Byte <i>n2</i> = Second Byte	16-63*

Locations 00-15 (Hex) are reserved.

Set or Cancel Parallel Journal Printing

Because there is no journal station on the 7156, this command is not implemented and is ignored if received.

Hex	Decimal	ASCII
1B 7A <i>n</i>	27 122 <i>n</i>	ESC z <i>n</i>

Reverse Feed *n* Lines (Slip Station)

Reverses the paper feed in the slip station by *n* lines at the current spacing. The next Character Feed command reverses the paper feed back to the normal feed direction.

Hex	Decimal	ASCII	Value of <i>n</i>
1D 14 <i>n</i>	29 20 <i>n</i>	GS DC4 <i>n</i>	1-255

Reverse Feed *n* Dots (Slip Station)

Reverses the paper feed in the slip station by *n* dots at 1 / 72 inch (NCR 7150™ command). The next Dot Feed command reverses the paper feed back to the normal feed direction.

Hex	Decimal	ASCII	Value of <i>n</i>
1D 15 <i>n</i>	29 21 <i>n</i>	GS NAK <i>n</i>	1-255

Journal Tab

As there is no journal station on the 7156, this command is ignored as a tab command. However, it is identical to the **Select Receipt Station (1E)** command and is used as indicated under the following conditions:

- If either the receipt or slip station is selected by **Select Receipt or Slip for Printing or MICR (1B 63 60 n)**, the command (1E) is ignored
- If the slip station is selected by **Select Slip Station (1C)**, the command (1E) selects the receipt station

See “Station Select Commands” later in this chapter for more information.

Hex	Decimal	ASCII
1E	30	RS

Print Characteristics Commands

These commands control what the printed information looks like. They control which character set is selected, enable you to define your own characters, set the margins, and allow you to produce graphics.

Double-Wide Characters

Prints double-wide characters. The printer is reset to single-wide mode after a line has been printed or after the **Clear Printer (10)** command is received. Double-wide characters may be used in the same line with single-wide characters, but not in the same line with rotated characters or with single or double-density graphics.

Hex	Decimal	ASCII
12	18	DC2

Single-Wide Characters

Prints single-wide characters. Single-wide characters may be used in the same line with double-wide characters, but not in the same line with rotated characters or with single or double-density graphics.

Hex	Decimal	ASCII
13	19	DC3

Rotated Print

Rotates characters 90 degrees counterclockwise. The command remains in effect until the printer is reset or the **Clear Printer (10)** command is received. The command is valid only when input at the beginning of a line. Rotated print and non-rotated print characters cannot be used together in the same line. See “Summary of Rotated Printing” on page 99.

Hex	Decimal	ASCII
1B 12	27 18	ESC DC2

Select Pitch (Column Width)

Selects the character pitch for a print line. This command is valid only when input at the beginning of a line. Standard and compressed pitches cannot be used together in the same line. See Appendix A for a description of the character pitches (print modes).

Hex	Decimal	ASCII	Value of <i>n</i>	Default
1B 16 <i>n</i>	27 22 <i>n</i>	ESC SYN <i>n</i>	0 = Standard Pitch 1 = Compressed Pitch	0

The following table provides the print characteristics for both pitches on the receipt and slip stations.

Pitch	Receipt Columns	Receipt CPI	Slip Columns	Slip CPI
Standard	44	15.2	66	13.9
Compressed	56	19.0	80	17.1

Set Print Mode

Selects the print mode: standard, compressed, double high, or double wide. See Appendix A for a description of the standard and compressed character pitches (print modes).

Hex	Decimal	ASCII	Value of <i>m</i>	Default
1B 21 <i>m</i>	27 33 <i>m</i>	ESC ! <i>m</i>	See Next Table	0

Value of <i>m</i>				
Bit	Function	0	1	
Bit 0 ¹	Pitch	Standard Pitch ² 44 Col / Line, 15 CPI (Rec) 66 Col / Line, 13.9 CPI (Slip)	Compressed Pitch 56 Col / Line, 19 CPI (Rec) 80 Col / Line, 17.1 CPI (Slip)	
Bit 4	Double High ³	Canceled	Set	
Bit 5	Double Wide	Canceled	Set	

¹Bit 0 is ignored unless it is at beginning of line. Bits 1, 2, 3, 6, 7 are not used.

²Standard and compressed pitch cannot be used together in the same line.

³Double-high characters cannot be used with normal characters in the same line, nor can they be used on the slip station.

Select Character Set

Selects the character set. The character sets cannot be used together on the same line. When an undefined RAM character is selected, the Code Page 437 character is used. See Appendix A for the character sets.

Hex	Decimal	ASCII	Value of <i>n</i>	Default
1B 25 <i>n</i>	27 37 <i>n</i>	ESC % <i>n</i>	<i>n</i> = 0: Code Page 437 <i>n</i> = 1: User defined (RAM character set) <i>n</i> = 2: Code Page 850	0

Define User-Defined Character Set (Receipt Station)

Defines and enters downloaded characters (for the receipt station) into RAM. It may be used to overwrite single characters. The user-defined characters are available until power to the printer is turned off, an Initialize Printer command (1B 40) is received, or a downloaded bit image (1D 2A) is defined.

User-defined character sets for both slip and receipt may be used at the same time. The command clears bit image logo data from RAM. See the illustration on the next page of a sample character cell.

Hex	Decimal	ASCII
1B 26 3 c1 c2 n1 d1 . . . nn dn	27 38 3 c1 c2 n1 d1 . . . nn dn	ESC & 3 c1 c2 n1 d1 . . . nn dn

c = the ASCII codes of the first (*c1*) and last (*c2*) characters respectively

c1 = Hex 20-FF (Hex 20 is always printed as a space)

c2 = Hex 20-FF (Hex 20 is always printed as a space)

To define only one character, use the same code for both *c1* and *c2*

n = the number of dot columns for the *n*th character as specified by *n1* . . . *nn*

n = 1-10 (standard pitch), 12 and less accepted but ignored

n = 1-8 (compressed pitch), 12 and less accepted but ignored

d = the column data for the *n*th character as specified by *d1* . . . *dn*

The number of bytes for a particular character cell is 3 x *n1*

The bytes are printed down and across each cell

Define User-Defined Character Set (Slip Station)

Defines and enters downloaded characters (for the slip station) into RAM (this command is both an NCR 7150™ and an Epson TM-T80™ command).

Hex	Decimal	ASCII
1B 26 0 c1 c2 d1 . . . dn	27 38 0 c1 c2 d1 . . . dn	ESC & 0 c1 c2 d1 . . . dn

c = the ASCII codes of the first (*c1*) and last (*c2*) characters respectively

c1 = Hex 20-FF (Hex 20 is always printed as a space)

c2 = Hex 20-FF (Hex 20 is always printed as a space)

To define only one character, use the same code for both *c1* and *c2*

d = the column data for the *n*th character as specified by *d1 . . . dn*

Each character is defined by 12 bytes (only bytes 2-11 are printed)

Each byte is one 7-dot high column (full- or half-dot column)

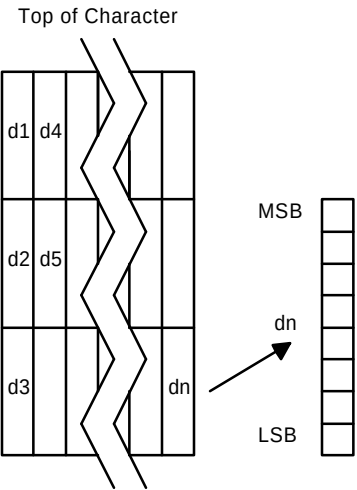
Overlapped dots are not printed

The data must contain [(*c2* - *c1* + 1) x 12] bytes

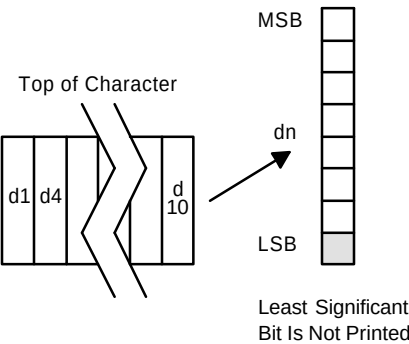
This command may be used to overwrite single characters. It will clear bit image data from RAM. The user-defined characters are available until power to the printer is turned off, an Initialize Printer command (1B 40) is received, or a downloaded bit image (1D 2A) is defined.

User-defined character sets for both slip and receipt may be used at the same time. See the illustration below of a sample character cell.

Receipt Characters (1B 26 3)



Slip Characters (1B 26 0)



Copy Character Set from ROM to RAM

Copies characters in the active ROM set to RAM. Use this command to re-initialize the user defined character set. Code Page 437 is copied by default at initialization.

Hex	Decimal	ASCII
1B 3A 0 0 0	27 58 0 0 0	ESC : 0 0 0

Enable Double Strike (Slip Station)

Overprints a second pass of the print line on the slip station to improve penetration of multiple forms and increase print contrast. The second pass is printed the same direction as the first to ensure accuracy of the overprint. The printer is reset to the standard print mode after a line has been printed or after a **Clear Printer (10)** command is received.

Hex	Decimal	ASCII
1B 47	27 71	ESC G

Disable Double Strike (Slip Station)

Turns off the double strike mode on the slip station.

Hex	Decimal	ASCII
1B 48	27 72	ESC H

Select Character Code Table

Selects the character set to be used. Code Page 437 and Code Page 850 cannot be used together on the same line. See Appendix A for both character sets.

Hex	Decimal	ASCII	Value of <i>n</i>	Default
1B 52 <i>n</i>	27 82 <i>n</i>	ESC R <i>n</i>	0 = Code Page 437	0
1B 74 <i>n</i> *	27 116 <i>n</i> *	ESC t <i>n</i> *	1 = Code Page 850	

Set or Cancel Rotated Print

Rotates characters 90 degrees clockwise. It remains in effect until the printer is reset or until a **Clear Printer (10)** or **Rotated Print (1B 12)** command is received. It is valid only at the beginning of a line. Rotated print and non-rotated print cannot be used together in the same line. See “Summary of Rotated Printing” on the next page.

Hex	Decimal	ASCII	Value of <i>n</i>	Default
1B 56 <i>n</i>	27 86 <i>n</i>	ESC V <i>n</i>	0 = Cancel	0
			1 = Set	

Set or Cancel Upside-Down Print

Prints upside-down characters. It is valid only at the beginning of a line. The character order is inverted in the buffer so text is readable. Upside-down and right-side up print cannot be used together in the same line. It remains in effect until the **Rotated Print (1B 12)** command is received. Only bit 0 is used. Bits 1-7 are not used. See “Summary of Rotated Printing” on the next page.

Hex	Decimal	ASCII	Value of <i>n</i>	Default
1B 7B <i>n</i>	27 123 <i>n</i>	ESC { <i>n</i>	0 = Cancel	0
			1 = Set	

Summary of Rotated Printing

The table shows the combinations of Set / Cancel Upside-Down Print, Set / Cancel Rotated Print (clockwise), and Rotated Print (counterclockwise). Rotated CCW is mutually exclusive with the other two commands.

The samples of the print show only the normal size characters. Double-wide and double-high characters are printed in the same orientation (double-high characters cannot be printed on the slip station). They may also be mixed on the same line.

Upside Down 1B 7B <i>n</i>	Rotated CW 1B 56 <i>n</i>	Rotated CCW 1B 12	Resulting Output
Canceled	Canceled	Cleared	1 (See Below)
Canceled	Set	X	2 (See Below)
Set	Canceled	X	3 (See Below)
Set	Set	X	4 (See Below)
X	X	Set	5 (See Below)

Note: The following print modes cannot be mixed on the same line:

- Standard and compressed pitch
- Vertical (normal) and rotated
- Right-side up and upside down
- Single high (normal) and double high

Station Select Commands

These commands decide which station any incoming data will be printed on.

Select Receipt or Slip for Printing, Slip for MICR Read

Selects the station for printing. If a slip is present and the station selected changes from slip to receipt, the slip is ejected. If the station selected changes from receipt to slip, the printer waits for a slip or check to be inserted, either for printing or for reading the MICR characters. See **Set Slip Waiting Time (1B 66 m n)**.

As there is no journal station on the 7156, bit 0 and bit 1 both select the receipt station. In the Epson TM-930™ the command can be used to select the journal station (bit 0). The command is valid only when input at the beginning of a line.

Hex	Decimal	ASCII	Value of <i>n</i>
1B 63 30 <i>n</i>	27 99 48 <i>n</i>	ESC c 0 <i>n</i>	1, 2, 3 = Receipt 4 = Slip

Select Receipt or Slip for Setting Line Spacing

Selects the station for setting line spacing. As there is no journal station on the 7156, bit 0 and bit 1 both select the receipt station. In the Epson TM-930™ the command can be used to select the journal station (bit 0).

Hex	Decimal	ASCII	Value of <i>n</i>
1B 63 31 <i>n</i>	27 99 49 <i>n</i>	ESC c 1 <i>n</i>	1, 2, 3 = Receipt 4 = Slip

Select Slip Station

Selects the Slip Station for all functions. The receipt station is the default setting after the printer is initialized or the **Clear Printer (10)** command is received. If a select command for one station is followed by a select for another station with no data sent for the first station, only the second station will be selected.

Hex	Decimal	ASCII
1C	28	FS

Select Receipt Station

Selects the Receipt Station for all functions. The receipt station is the default setting after the printer is initialized or the **Clear Printer (10)** command is received. If a select command for one station is followed by a select for another station with no data sent for the first station, only the second station will be selected.

Note: This command is identical to **Journal Tab (1E)**, an Epson TM-930™ command. As there is no journal station on the 7156, this command is ignored as a tab command. The following conditions occur when this command is used:

- If either the receipt or slip station is selected by **Select Receipt or Slip for Printing or MICR (1B 63 60 n)**, the command (1E) is ignored
- If the slip station is selected by **Select Slip Station (1C)**, the command (1E) selects the receipt station

See “Printer Function Commands” earlier in this chapter for more information.

Hex	Decimal	ASCII
1E	31	RS

Graphics Commands

These commands are used to enter and print graphics data.

Set Absolute Starting Position

Sets the print starting position for graphics on the receipt station at the specified number of dots from the beginning of the line as expressed in the following formula: $n = ((n1 + (256 \times n2)) \times 2)$. The resulting dot column must be less than 448. The print starting position is reset to column one after each line.

This command emulates the Epson LQ-950™ dot matrix printer. This allows the 7156 to accept graphics that are normally output from word processing programs to a half-dot matrix printer.

Hex	Decimal	ASCII
1B 24 <i>n1 n2</i>	27 36 <i>n1 n2</i>	ESC \$ <i>n1 n2</i>
<i>n</i> = Number of half dots to be moved from the beginning of the line		
Note: The 7156 converts two half-dots to one full dot		
<i>n1</i> = Remainder after dividing <i>n</i> by 256		
<i>n2</i> = Integer after dividing <i>n</i> by 256		

Set Bit Image Mode

Sets the print resolution and enters one line of graphics data into the print buffer. Excess data is accepted but ignored. Any print command is required to print the data, after which the printer returns to normal processing mode. See the illustration on the next page for a graphic representation of the bit image.

Hex	Decimal	ASCII
1B 2A <i>m n1 n2 d1...dn</i>	27 58 <i>m n1 n2 d1...dn</i>	ESC : <i>m n1 n2 d1...dn</i>

Receipt Station

Value of <i>m</i>	Mode	No. of Dots (Vertical)	No. of Dots (Horizontal)	Number of Dots/Line
0	8 Dot Single Density	8 (51 DPI)	224 (76 DPI)	8 x 224
1	8 Dot Double Density	8 (51 DPI)	448 (152 DPI)	8 x 448
32	24 Dot Single Density	24 (152 DPI)	224 (76 DPI)	24 x 224
33	24 Dot Double Density	24 (152 DPI)	448 (152 DPI)	24 x 448

Slip Station

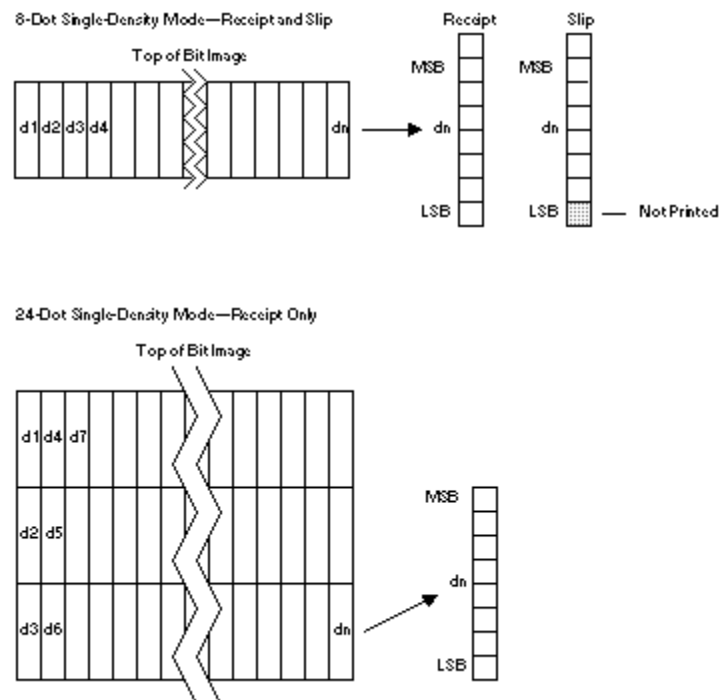
Value of <i>m</i>	Mode	No. of Dots (Vertical)	No. of Dots (Horizontal)	Number of Dots/Line
0	7 Dot Single Density	7 (72 DPI)	330 (69.5 DPI)	7 x 330
1*	7 Dot Double Density	7 (72 DPI)	660 (139 DPI)	7 x 660
32, 33	Not Available on Slip			

In single density, one byte (7 dots) is printed in each full dot column; in double density, one byte is printed in each half/full dot column.

*Adjacent horizontal dots (overlapping dots) are not printed on the slip.

Value of <i>n</i> (8-Dot Single-Density Mode)	Value of <i>n</i> (24-Dot Single-Density Mode)	Value of <i>d</i>
$n1 + (256 \times n2)$	$3 \times [n1 + (256 \times n2)]$	Number of Bytes of Data*

*Printed left to right (8-dot mode); Printed down then across (24-dot mode).



Single-Density Graphics

This NCR 7150™ command is not available. Use **Set Bit Image Mode (1B 2A)** described on the previous page. The Hex code, 1B 4B, is used for an Epson command, **Print and Reverse Feed *n* Minimum Units (1B 4B *n*)**.

Double-Density Graphics

Enters one line of 8-dot double-density graphics into the print buffer. Excess data is accepted but ignored. Any print command is required to print the data, after which the printer returns to normal processing mode.

Double-density mode allows 0-448 dot columns on the receipt, 0-660 dot columns on the slip. The number of bytes sent is represented by the formulas in the second table. Each bit corresponds to one horizontal dot. Adjacent horizontal dots (overlapping dots) will not be printed on the slip. Compare this command to **Set Bit Image Mode (1B 2A...)**.

Hex	Decimal	ASCII
1B 4C <i>n1 n2 d1...dn</i>	27 76 <i>n1 n2 d1...dn</i>	ESC L <i>n1 n2 d1...dn</i>
1B 59 <i>n1 n2 d1...dn</i>	27 89 <i>n1 n2 d1...dn</i>	ESC Y <i>n1 n2 d1...dn</i>

Value of <i>n</i> (8-Dot Double-Density Mode)	Value of <i>d</i>
$n1 + (256 \times n2)$	Number of Bytes of Data*

Printed left to right.

Define Downloaded Bit Image (Receipt Station)

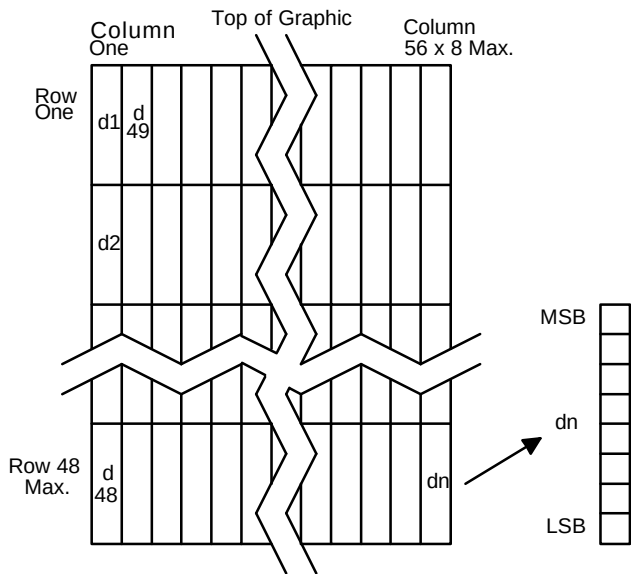
Enters a downloaded bit image (such as a logo) into 16K of RAM for the receipt station with the number of dots specified by *n1* and *n2*. The downloaded bit image is available until power to the printer is turned off, or until **Initialize Printer (1B 40)**, another **Downloaded Bit Image (1D 2A)**, or **Define User-Defined Character Set (1B 26)** is received.

The downloaded bit image and user-defined characters cannot be defined at the same time. Any user-defined characters will be cleared from RAM when this command is used. See the illustration for a graphic representation of the downloaded bit image.

Hex	Decimal	ASCII
1D 2A <i>n1 n2 d1...dn</i>	29 42 <i>n1 n2 d1...dn</i>	GS * <i>n1 n2 d1...dn</i>

Value of <i>n1</i>	Value of <i>n2</i>	Value of <i>d</i>
1-56 (8 x <i>n1</i> = Number of Horizontal Dot Columns)	1-48 (Number of Vertical Bytes)*	Bytes of Data (Printed Down Then Across)

*The number of bytes sent is represented by the following formula:
 $n = 8 \times n1 \times n2$ ($n1 \times n2$ must be less than or equal to 1344).



Print Downloaded Bit Image (Receipt Station)

Prints a downloaded bit image (such as a logo) on the receipt station at a density specified by *m*. It is ignored if any data is in the print buffer, if the downloaded bit image is undefined, or if the data defined exceeds one line. A downloaded bit image and user-defined characters cannot be used at the same time.

Hex	Decimal	ASCII	Value of <i>m</i>	Print Mode	Vertical DPI*	Horizontal DPI*
1D 2F <i>m</i>	29 47 <i>m</i>	GS / <i>m</i>	0	Normal	152	152
			1	Double Wide	152	76
			2	Double High	76	152
			3	Quadruple	76	76

*Dot density measured in dots per inch.

Printer Status Commands

These commands enable the printer to communicate with the host system following the selected handshaking protocol, either DTR/DSR or XON/XOFF. They are stored in the printer's data buffer as they are received, and are handled by the firmware in the order in which they were received.

When a fault occurs, the printer will go busy at the RS-232C interface and not respond to either of the Printer Status commands. If the fault causing the busy condition can be cleared, such as by loading receipt or slip paper, or letting the thermal printhead cool down, the printer will resume processing the data in its receive buffer.

If a slip jam caused the busy condition and the application is not using Real Time commands for status and recovery, clear the jam and press the online button to cycle the printer. See the following section, "Real Time Commands" for details about the Real Time commands.

Transmit Cash Drawer Status

Transmits the current status of the cash drawers. One byte is sent to the host system. In DTR/DSR protocol, the printer waits for DSR = SPACE. If a drawer is not connected, the status will indicate it is closed.

Hex	Decimal	ASCII	Bit	1 Signifies	0 Signifies
1B 75 0	27 117 0	ESC u 0	0	Drawer 1 Closed	Drawer 1 Open
			1	Drawer 2 Closed	Drawer 2 Open

Transmit Printer Status

Sends status data to the host system.

Hex	Decimal	ASCII
1B 76	27 118	ESC v

The printer sends one byte to the host system. See the table below. In DTR / DSR protocol, the printer waits for DSR = SPACE.

Status Byte (RS-232C)

Bit	Function	0 Signifies	1 Signifies
0	Receipt Paper	Ok	Low
1	Receipt Cover or Front Cover	Closed	Open
2	Receipt Paper	Ok	Out
3	Always Zero		
4	Always Zero		
5	Slip Leading Edge Sensor	Not Covered	Covered
6	Slip Trailing Edge Sensor	Not Covered	Covered
7	Always Zero		

Real Time Commands

These commands correct difficulties with the original version of the 7156 RS-232C communication interface:

- Real Time Status Transmission (GS Sequence and DLE Sequence)
- Real Time Request to Printer (GS Sequence and DLE Sequence)
- Real Time Printer Status Transmission

The original Printer Status commands, **Transmit Printer Status (1B 76—ESC v)** and **Transmit Cash Drawer Status (1B 75 0—ESC u 0)** are placed in the printer's data buffer as they are received and handled by the firmware in the order in which they were received. If the paper exhausts while printing data which was in the buffer ahead of the status command, the printer goes busy at the RS-232C interface and suspends processing the data in the buffer until paper is reloaded. This is true for all error conditions: knife home error, slip paper jam, thermal printhead overheat, etc.

In addition, there is no way to restart the printer after a paper jam, or to cancel a slip waiting condition when using the **Wait for Slip (ESC c 0 0x04)** command.

The Real Time commands are implemented in two ways to correct these problems. Both implementations offer the same functionality; which one you choose depends on the current usage of your application. For a new application the GS sequences of the first implementation are recommended to avoid possible misinterpretation of a DLE sequence as a **Clear Printer (10 0—DLE NUL)** command.

The first implementation builds upon the GS ENQ sequence as implemented on Epson's TM-930II™, TM-950™ and TM-U950™ by defining two new GS (0x1D) sequences to provide the same functions as the DLE sequences above, and to provide complete backward compatibility to the original 7156 Clear Printer command.

An application using these GS sequences does not need to distinguish for the printer between the new real time commands and the old Clear Printer command. This implementation is ideal for an existing 7156 application which already uses the Clear Printer command or for a new application being developed.

The alternate implementation uses the DLE (0x10) sequences as implemented on Epson's TM-T85™ and TM-U950™. An application using these DLE sequences and the original 7156 Clear Printer command (0x10) must distinguish for the printer between the new real time commands and the old Clear Printer command by adding a NUL (0x00) to the Clear Printer command.

An application using these DLE sequences must also send the second byte of the sequence within 100 milliseconds of the first, to prevent the first byte being mistaken for a Clear Printer command. This implementation is useful for an existing TM-T85™ or TM-U950™ application which is being migrated to a 7156. This application would not be using the 7156 Clear Printer command at all since it is not recognized by the Epson printers.

Note: The DLE sequences as implemented on Epson's TM-T85™ and TM-U950™ are not exactly the same as those implemented on Epson's TM-950™.

Both implementations also provide the original GS ENQ real time sequence in addition to the newer real time sequences.

Three situations must be understood when using real time commands.

1. First, the printer executes the real time command upon receiving it and will transmit status regardless of the condition of the DSR signal.
2. Second, the printer transmits status whenever it receives the real time status transmission command sequence, even if that sequence happens to occur within the data of another command, such as graphics data.

In this case the sequence will also be handled correctly as the graphics data it is intended to be when the graphics command is executed from the buffer.

3. Care must be taken not to send a real time command within the data sequence of another command that consists of two or more bytes.

In this case the printer will use the real time command sequence bytes instead of the other command's bytes when finally executing that other command from the buffer; the other command will not be executed correctly.

These three situations generally preclude use of standard DOS drivers for the serial communication ports when using real time commands.

Another consideration is that an application should take care not to let the buffer fill up with real time commands when the printer is busy at the RS-232C interface. A busy condition at the RS-232C interface can be determined by bit 3 of the response to GS ENQ or GS EOT 1 or DLE EOT 1. The reason for a particular busy condition can be determined by other responses to GS EOT n or DLE EOT n.

Although the printer responds to real time commands when it is busy, it will place them into the buffer behind any other data there, and flush them out in the order in which they were received. When the printer is busy due simply to buffer full (that is, it can't print data as fast as it can receive it), then data continues to be processed out of the buffer at approximately print speed and the real time commands will eventually get flushed out.

When the printer is busy due to an error condition, then data stops being processed out of the buffer until the condition clears one way or another. In either case, but more quickly in the case of an error condition, the buffer can fill with real time commands.

When the DLE sequences are being used, the last byte stored when the buffer fills up could be the DLE code, with no room for the subsequent EOT or ENQ. When this lone DLE byte is finally processed out of the buffer it will be interpreted as a Clear Printer command.

Similarly, when the GS sequences are being used, the last byte stored when the buffer fills up could be the GS code, with no room for the subsequent EOT or ETX or ENQ. When this lone GS byte is finally processed out of the buffer it will use the next byte, whatever it is, as the second byte in its GS sequence.

To guard against this situation, an application should determine the cause of a busy condition and take appropriate action or pace further real time commands to avoid filling the buffer. There are a minimum of 256 bytes available in the printer's buffer when it goes busy.

Real Time Status Transmission

Transmits the selected one byte printer status specified by *n* in real time according to the following parameters.

GS Sequence

Hex	Decimal	ASCII	Value of <i>n</i>
1D 04 <i>n</i>	29 4 <i>n</i>	GS EOT <i>n</i>	1 = Transmit printer status 2 = Transmit RS-232C busy status 3 = Transmit error status 4 = Transmit receipt paper status 5 = Transmit slip paper status

The command is ignored if *n* is out of range.

DLE Sequence

Hex	Decimal	ASCII	Value of <i>n</i>
10 04 <i>n</i>	16 4 <i>n</i>	DLE EOT <i>n</i>	1 = Transmit printer status 2 = Transmit RS-232C busy status 3 = Transmit error status 4 = Transmit receipt paper status 5 = Transmit slip paper status

The command is ignored if *n* is out of range.

Note: An application using the DLE sequence must send EOT within 100 milliseconds of DLE or the printer will misinterpret the DLE and execute a Clear Printer command. Avoid this possibility by using the GS EOT *n* sequence which is handled exactly the same as DLE EOT *n*.

1 = Transmit Printer Status

Bit	Status	Hex	Decimal	Function
0	Off	00	0	Fixed to Off
1	On	02	2	Fixed to On
2	Off	00	0	One or both cash drawers open
	On	04	4	Both cash drawers closed
3	Off	00	0	Not busy at the RS-232C interface
	On	08	8	Printer is Busy at the RS-232C interface
4	On	10	16	Fixed to On
5				Undefined
6				Undefined
7	Off	00	0	Fixed to On

2 = Transmit RS-232C Busy Status

Bit	Status	Hex	Decimal	Function
0	Off	00	0	Fixed to Off
1	On	02	2	Fixed to On
2	Off	00	0	Both receipt and cassette doors closed
	On	04	4	Receipt or cassette door open
3	Off	00	0	Paper feed button is not pressed
	On	08	8	Paper feed button is pressed
4	On	10	16	Fixed to On
5	Off	00	0	Printing not stopped due to paper condition
	On	20	32	Printing stopped due to paper condition
6	Off	00	0	No error condition
	On	40	64	Error condition exists in the printer
7	Off	00	0	Fixed to Off

3 = Transmit Error Status

Bit	Status	Hex	Decimal	Function
0	Off	00	0	Fixed to Off
1	On	02	2	Fixed to On
2	Off	00	0	No slip motor jam
	On	04	4	Slip motor jam occurred
3	Off	00	0	No knife error
	On	08	8	Knife error occurred
4	On	10	16	Fixed to On
5	Off	00	0	No unrecoverable error
	On	20	32	Unrecoverable error occurred
6	Off	00	0	Thermal printhead temp./ power supply voltage are in range
	On	40	64	Thermal printhead temp./ power supply voltage are out of range
7	Off	00	0	Fixed to Off

4 = Transmit Receipt Paper Status

Bit	Status	Hex	Decimal	Function
0	Off	00	0	Fixed to Off
1	On	02	2	Fixed to On
2	Off	00	0	Receipt paper adequate
	On	04	4	Receipt paper low
3	Off	00	0	Receipt paper adequate
	On	08	8	Receipt paper low
4	On	10	16	Fixed to On
5	Off	00	0	Receipt paper present
	On	20	32	Receipt paper exhausted
6	Off	00	0	Receipt paper present
	On	40	64	Receipt paper exhausted
7	Off	00	0	Fixed to Off

5 = Transmit Slip Paper Status

Bit	Status	Hex	Decimal	Function
0	Off	00	0	Fixed to Off
1	On	02	2	Fixed to Off
2	Off	00	0	Slip paper selected
	On	04	4	Receipt paper selected
3	Off	00	0	Not waiting for slip to be inserted
	On	08	8	Waiting for slip to be inserted
4	On	10	16	Fixed to On
5	Off	00	0	Slip leading edge sensor: paper present
	On	20	32	Slip leading edge sensor: no paper
6	Off	00	0	Slip trailing edge sensor: paper present
	On	40	64	Slip trailing edge sensor: no paper
7	Off	00	0	Fixed to Off

Real Time Request to Printer

The printer responds to a request from the host specified by *n*. The operations performed depend on the value of *n*, according to the following parameters.

GS Sequence

Hex	Decimal	ASCII	Value of <i>n</i>
1D 03 <i>n</i>	29 3 <i>n</i>	GS ETX <i>n</i>	1 = Recover and restart 2 = Recover and clear buffers 3 = Cancel slip waiting

The command is ignored if *n* is out of range.

DLE Sequence

Hex	Decimal	ASCII	Value of <i>n</i>
10 05 <i>n</i>	16 5 <i>n</i>	DLE ENQ <i>n</i>	1 = Recover and restart 2 = Recover and clear buffers 3 = Cancel slip waiting

The command is ignored if *n* is out of range.

Note: An application using the DLE sequence must send ENQ within 100 milliseconds of DLE or the printer will misinterpret the DLE and execute a Clear Printer command. Avoid this possibility by using the GS ETX *n* sequence which is handled exactly the same as DLE ENQ *n*.

n = 1

Restarts printing from the beginning of the line where an error occurred, after recovering from the error. Print settings that are normally preserved from line to line, such as character height and width, are still preserved with this command. This sequence is ignored except when the printer is busy due to an error condition.

If the receipt is selected, this command will attempt recovery from a knife error. Other errors associated with the receipt, such as paper out or printhead overheating, can be recovered from only by clearing the specific condition, such as loading paper or letting the printhead cool down.

If the slip is selected, this command will attempt recovery from a slip motor jam by rehoming the printhead and waiting for a slip to be inserted before restarting the print. Other errors associated with the slip, such as cassette door open, can be recovered from only by clearing the specific condition, such as closing the cassette door.

 $n = 2$

Recovers from an error after clearing the receive and print buffers. Print settings that are normally preserved from line to line, such as character height and width, are still preserved with this command. This sequence is ignored except when the printer is busy due to an error condition.

If the slip was selected when the error occurred, the receipt becomes selected when the buffers are cleared. When printing on the slip is to continue, the slip must be selected again.

The same error recovery possibilities exist as for $n = 1$.

 $n = 3$

Cancels the slip waiting status. This sequence is ignored except when the printer is waiting for a slip to be inserted.

When slip waiting is canceled, the receive and print buffers are cleared and the receipt is selected. When printing on the slip is to continue, the slip must be selected again.

Real Time Printer Status Transmission

Transmits one byte status of the printer in real time.

Hex	Decimal	ASCII
1D 05	29 5	GS ENQ

Bit	Status	Hex	Decimal	Function
0	Off	00	0	Receipt paper adequate
	On	01	1	Receipt paper low
1	Off	00	0	Receipt paper adequate
	On	02	2	Receipt paper low
2	Off	00	0	Both receipt and cassette doors closed
	On	04	4	Receipt or cassette door open
3	Off	00	0	Not busy at the RS-232C interface
	On	08	8	Printer is busy at the RS-232C interface
4	Off	00	0	One or both cash drawers open
	On	10	16	Both cash drawers closed
5	Off	00	0	Paper present at both slip sensors
	On	20	32	Paper not present at one or both slip sensors
6	Off	00	0	No error condition
	On	40	64	Error condition exists in the printer
7	On	80	128	Fixed to On

7156 Clear Printer Command

Resets certain parameters and clears the print buffer as originally defined. This is NOT a Real Time command. It only distinguishes the Clear Printer command from other DLE sequences.

Hex	Decimal	ASCII
10 00	16 0	DLE NUL

Recognizing Data from the Printer

An application sending various real time and non-real time commands to which the printer responds can determine which command a response belongs to by the following table. Note that a response to GS EOT *n* or DLE EOT *n* cannot be distinguished from ASCII data coming from a MICR read.

While MICR data is still outstanding, an application should use the real time GS ENQ. A response to GS ENQ can still arrive “inside” ASCII MICR data, but it can be recognized and extracted. And although ASCII MICR data cannot be distinguished from responses to ESC *u* and ESC *v*, those are all non-real time responses and will arrive in the order in which they were solicited.

Note also that although the original intent of the response to ESC *v* was to provide motor jam information in bit 3 and out-of-range temperature and voltage information in bit 7, these bits will always be 0 when transmitted. This is due to the fact that ESC *v* is not processed until the error condition is cleared.

ESC <i>u</i> 0	0	0	0	0	0	0	x	x	Binary
ESC <i>v</i>	0	x	x	0	0	x	x	x	Binary
ESC <i>w</i> 1	0	0	0	0	1	1	0	1	Binary (Carriage Return)
(MICR read)	0	0	1	x	x	x	x	x	Binary (<i>n</i> = 0x20-0x2F)
	0	1	1	x	x	x	x	x	Binary (<i>n</i> = 0x30-0x7F)
GS EOT <i>n</i>	0	x	x	1	x	x	1	0	Binary
DLE EOT <i>n</i>	0	x	x	1	x	x	1	0	Binary
GS ENQ	1	x	x	x	x	x	x	x	Binary
XON	0	0	0	1	0	0	0	1	Binary
XOFF	0	0	0	1	0	0	1	1	Binary

Bar Code Commands

These commands format and print bar codes on the receipt station.

Select Printing Position of HRI Characters (Receipt Station)

Prints HRI characters (Human Readable Interface) above or below the bar code.

Hex	Decimal	ASCII	Value of <i>n</i> (Printing Position)	Default
1D 48 <i>n</i>	29 72 <i>n</i>	GS H <i>n</i>	0 = Not Printed 1 = Above the Bar Code 2 = Below the Bar Code 3 = Both Above and Below the Bar Code	0

Select Pitch of HRI Characters (Receipt Station)

This command is not implemented and is ignored if received.

Hex	Decimal	ASCII	Value of <i>n</i> (Pitch)	Default
1D 66 <i>n</i>	29 102 <i>n</i>	GS f <i>n</i>	0 = Standard Pitch at CPI 1 = Compressed Pitch at 19 CPI	0

Select Height of Bar Code (Receipt Station)

Sets the bar code height to *n* dots or *n* / 152 inch (*n* / 6 mm).

Hex	Decimal	ASCII	Value of <i>n</i>	Default
1D 68 <i>n</i>	29 104 <i>n</i>	GS H <i>n</i>	1-255	162

Print Bar Code (Receipt Station)

Selects the bar code type and prints a bar code for the ASCII characters entered.

Hex	Decimal	ASCII	Value of <i>n</i>	Value of <i>c</i>
1D 6B	29 107	GS k	0-7	ASCII
<i>n c1 c2...00</i>	<i>n c1 c2...00</i>	<i>n c1 c2...00</i>	(See Table)	Characters

00 = End of command.

<i>n</i>	Bar Code	Length
0	UPC-A	Fixed Length
1	UPC-E	Fixed Length
2	JAN13 (EAN)	Fixed Length
3	JAN8 (EAN)	Fixed Length
4	Code 39	Variable Length
5	Interleaved 2 of 5	Variable Length
6	Codabar	Variable Length
7	Not Used	

Note: Fixed length codes can be aligned left, center, or right using the **Align Positions (1B 61)** command. Variable length codes are center aligned. When data is present in the print buffer, this command is ignored. The required paper feeding is performed, regardless of the current line spacing. If the horizontal size exceeds one line, the excess data is not printed. Illegal data cancels the command.

The printer will calculate the check digit for the UPC and JAN (EAN) codes if it is not sent from the host system. The printer will also generate six-character zero-suppressed UPC-E tags from full 11 or 12 characters sent from the host system according to standard UPC-E rules. Start/stop characters are provided for Code 39 if they are not included.

Print Code 128 Bar Code (Receipt Station)

Selects and prints the Code 128 bar code.

Hex	Decimal	ASCII	Value of <i>n</i>	Value of <i>dn</i>
1D 6B	29 107	GS k	1-255	0-105
49 <i>n dn</i>	73 <i>n dn</i>	I <i>n dn</i>		

Since the characters encoded via Code 128 include the NUL (0x00) character, a NUL cannot be used to terminate the Code 128 bar code sequence as is done with other bar code sequences. The number of characters to be encoded is variable and is specified by *n*.

Following *n* are the data bytes: *dn*. The printer processes *n* bytes from the next character data as bar code data.

- The first data byte must be a Start code: d1 = 103-105.
- Data bytes past the Start code: d2 = 0-102.
- The printer provides the Stop code.

If character code d cannot be printed, the printer prints the processed bar code data up to that point and the following data is treated as normal data. If the horizontal size exceeds one line, the printer does not print the excess data.

This command is enabled only when no data is in the print buffer. When data is in the printer buffer, the printer processes the data following 'GS k I' as normal data.

Select Horizontal Size of Bar Code (Receipt Station)

Sets the bar code width to *n* dots or *n* / 152 inch (*n* / 6 mm).

Hex	Decimal	ASCII	Value of <i>n</i>	Default
1D 77 <i>n</i>	29 119 <i>n</i>	GS w <i>n</i>	2, 3, 4	3

MICR Reader Commands

These commands control the Magnetic Ink Character Recognition (MICR) Reader, including how it parses the character strings on checks. The remainder of this chapter explains these commands.

The section that follows, “MICR Parsing,” describes how to create a parsing format and how to create and maintain an exception table. If you would like a copy of a software utility that performs these functions rather than developing your own program using the command codes described in this section, please contact Axiohm IPB. The software utility can be used as provided or can be incorporated into your own application.

Read MICR Data and Transmit

Reads and transmits the MICR data and adds a **Carriage Return (0D)**. This command must follow **Select Receipt or Slip for Printing, Slip for MICR Read (1B 63 30 n)**. If no parsing format is selected with either of the **Define Parsing Format** commands (see below), all data will be returned, which is the default.

Hex	Decimal	ASCII
1B 77 01	27 119 1	ESC w 1

Define Parsing Format, Save in NVRAM

Defines and saves parsing format. See “Parsing Parameter String Options” on page 110. Send this command at the start of day or use in the setup application. If no parameters are selected, parsing is not performed.

Hex	Decimal	ASCII
1B 77 50 parameters	27 119 80 parameters	ESC w P parameters

Reread MICR Data

Resends the unparsed MICR data (as if the parsing has not been defined).

Hex	Decimal	ASCII
1B 77 52	27 119 80	ESC w P

Define Parsing Format, Do Not Save Permanently

Defines, but does not save parsing format. See “Parsing Parameter String Options” below. Send this command at the start of day or use in the setup application. If no parameters are selected, parsing is not performed.

Hex	Decimal	ASCII
1B 77 70 parameters	27 119 112 parameters	ESC w p parameters

MICR Parsing

This section describes the MICR parsing in more detail and includes several examples of useful parsing variations. It also describes how to create a parsing format and how to create and maintain an exception table.

If you would like a copy of a software utility that performs these functions rather than developing your own program using the command codes described in this section, please contact Axiohm IPB. The software utility can be used as provided or can be incorporated into your own application.

Parsing Parameter String Options

Variable Length Fields

Variable Length Field Name	Selector	Comments
Transit Number	T	Full 9 digit routing / transit number
Bank Number	B	Digits 4-8 of transit number
Check Digit	D	Digit 9 of transit number
Account Number	A	
Check Serial Number	C	Separate from account number
Amount	\$	This field may not be present or readable

Variable Length Field Optional

Modifiers	Selector	Comments
Zero fill to length	0	ASCII zero preceeding maximum length
Maximum length	nn	1- or 2-digit ASCII number
Remove space / dash	X	
Replace space / dash with 0	x	

Examples of Variable Length Field Format Specifications

Account #, all characters in the field, keep spaces and dashes	A
Account #, all characters in the field, replace spaces and dashes	xA
Account #, maximum 12 characters, keep spaces and dashes	12A
Account #, always 12 characters zero filled, remove spaces and dashes	012XA

Other Parameters

Error Number	E	One Digit Returned
	0	Read OK
	1	Read error: bad character, empty field invalid length, check digit invalid

Status	S	Two Digits Returned
	01	No MICR data
	09	Mexican check
	08	Canadian check
	05	Error in transit number
	07	Error in account number
	04	Error in check serial number
	10	Business or commercial check
	11	Amount field present
	00	No error

Field Separator	'x'
	Field separator preceded by a single quote, so a field separator of the letter A would be sent as 'A (0x27 0x41).
	If a Carriage Return is specified as a separator (0x27 0x0D), a final Carriage Return must still terminate the parsing parameter string.

Country Code	Un	One Digit Returned
	n	US check
	Km	m Canadian check
Check Type	L	One Digit Returned
	1	Personal check
	2	Business or commercial check

Ten parameters are more than enough to specify all variable length fields with a field separator each and other status information that may be helpful to an application. More than 10 parameters are not recommended because they use up space in non-volatile memory (NVRAM) available for the exception table.

The parsing parameter string is stored packed in NVRAM starting at word 10, with the total byte length stored in the high order byte of word 10. While most parameters take two bytes of NVRAM, the following parameters take only one byte: B, D, E, S, L. None of the parsing examples in the following section take more than 14 bytes (seven words) of NVRAM.

The exception table starts at word 20. If the parsing parameter string extends into word 20, then the first exception table entry is unavailable.

Sample Parsing Formats

The following strings show various sample formats that you can use assuming they meet your parsing format needs. Included with the sample format is a description of the data that is returned to the application.

ESC w p 18 A <CR>

- Maximum 18 characters in the account number
- Final Carriage Return

ESC w p 18 X A <CR>

- Maximum 18 characters in the account number with spaces and dashes removed
- Final Carriage Return

ESC w p 18 x A <CR>

- Maximum 18 characters in the account number with spaces and dashes replaced with 0
- Final Carriage Return

ESC w p 018 A <CR>

- Always 18 characters in the account number (high order zero-filled if necessary)
- Final Carriage Return

ESC w p 018 X A <CR>

- Always 18 characters in the account number with spaces and dashes removed
- Final Carriage Return

ESC w p 018 x A <CR>

- Always 18 characters in the account number with spaces and dashes replaced with 0
- Final Carriage Return

ESC w p T 18 X A 04C <CR>

- All characters in the transit number
- All characters in the account number (up to 18) with spaces and dashes removed
- Always four characters in the check number (zero-filled if check number is only three characters long)
- Final Carriage Return

ESC w p K9 X T 18 X A 04C <CR>

- U.S. check: all nine characters in the transit number (because there are no dashess)
- Canadian check: dash in transit number removed; “9” inserted at beginning, resulting in a fully numeric nine character transit number
- All characters in the account number (up to 18) with spaces and dashes removed
- Always four characters in the check number (zero-filled if check number is only three characters long)
- Final Carriage Return

ESC w p T / A / C / S <CR>

- All characters in the transit number
- Field separator: /
- All characters in the account number
- Field separator: /
- All characters in the check number
- Field separator: /
- Two-digit status
- Final Carriage Return

Notes

All parameters are ASCII characters, i.e. greater than or equal to 0x20, with the exception of a non-ASCII character enclosed in single quotes as a field separator. This applies both to parameter specifications sent from application to printer, and to MICR data returned from printer to application.

Parameters are positional; their order in the parameter string is the order in which the parsed MICR data will be returned. Unrecognized parameters will be ignored, and processing of the parsing parameters will stop. Any data remaining after the unrecognized parameter will be treated as normal input data.

If parameters are not defined (for example, ESC wP <CR> or ESC wp <CR>) parsing is not selected. One status byte, followed by all decoded MICR characters will be returned. See the descriptions of the commands on page 109 and 110. This is the default parsing format if no other is selected:

Status	Status Byte Value
Good read, data follows	0x00
Bad read, data follows	0x01
No check present, no data	0x02
Paper jam, no data	0x03
No MICR characters, no data	0x04

MICR Characters	ASCII	Hexadecimal
Numerics	0...9	0x30...0x39
Unrecognized Character	?	0x3F
Space		0x20
Amount symbol	&	0x26
Dash symbol	'	0x27
"on us" symbol	(	0x28
Transit symbol	)	0x29

Once a parsing format is specified, the following values are returned:

MICR Characters	ASCII	Hexadecimal
Numerics	0...9	0x30...0x39
Space		0x20
Dash	-	0x2D
Field separator*		
Country code*		

*As specified in the parsing parameter string

With RS-232C communication, the printer adds a final carriage return to the MICR data sent to the application.

Check Serial Number

Parsing the Check Serial Number

Most banks print the check serial number in three easily recognizable spots. The printer firmware will look for the number in these spots, using the following ordered algorithm. The examples use letters to represent symbols on the check:

- t Transit symbol
- o "on us" symbol
- \$ Amount symbol
- Dash
- c Check serial number
- x Any other number

A number bracketed by "on us" symbols in the auxiliary "on us" field is the check serial number.

o c c c c c c c o t x x x x x x x x x t x x x x x x x x o

Otherwise, a three or more digit number to the right of the rightmost "on us" symbol, and to the left of the leftmost amount symbol if an amount field is present, is the check serial number.

t x x x x x x x x x t x x x x x x x x o c c c c
t x x x x x x x x t x x x x x x x x o c c c c \$ x x x x x x \$

If both of these searches fail to produce the check serial number, extract the whole account number field from between the rightmost transit symbol and the rightmost “on us” symbol. A three, four, or five digit number to the right of the rightmost transit symbol, separated by a space or a dash from the rest of the account number is the check serial number.

```

xxxxxxxxxxt cccc xxxxxxxxo
xxxxxxxxxxt cccc-xxxxxxxxxo
xxxxxxxxxxt cccc xxxxxxxxo xx

```

If all of these searches fail to produce the distinct check serial number, and the check serial number field has been specified in the parsing parameter string options, no check serial number will be returned. If it is imbedded within the account number field, it will be returned as part of that variable length field.

Exceptions

Some banks print the check serial number in a location which cannot be electronically distinguished without specific exception information, although it can be visually distinguished because it is repeated in the upper right corner of the check. For these cases, the printer can hold up to nine exceptions for specific banks in its non-volatile memory (NVRAM), which is accessed by the read and write NVRAM commands. The specific bank is picked out by its transit number, and the firmware will look in the exception table for a transit number match before looking in the normal check serial number locations.

In this example, without an exception table entry, the firmware would always pick the rightmost four digit number as the check serial number following rule two above. The bank with the three digit check serial number and the four digit extension after the “on us” symbol would need to be exceptionally recognized:

```

xxxxxxxxxxt CCC-xxxxxxxxxxoxxxx
xxxxxxxxxxt xxx-xxxxxxxxxxocccc

```

In this example, without an exception table entry, the firmware would not be able to pick out the check serial number because it is not separated from the rest of the account number:

```

xxxxxxxxxxt cccxxxxxxxxxxo

```

In this example, without an exception table entry, the firmware would not be able to pick out the check serial number correctly, because it is imbedded within the rest of the account number:

```

xxxxxxxxxxt xxx-ccc-xxxxxxxxxo

```

Loading the Exception Table

The exception table begins at word 20 in NVRAM. Each entry takes five words. There is room for eight exceptions with a sumcheck written in the last word. An application can load local exceptions into the printer using the write NVRAM command:

```
0x1B 0x73 n1 n2 k
```

which writes the two byte word n1:n2 to word k in NVRAM.

Exception Table Entry Format

Each exception table entry consists of five words. The first two words contain the first eight characters of the transit number by packing the low order nibble of the numeric transit number characters. For Canadian checks, eliminate the dash and store the eight numerics.

The next three words are used as six individual bytes to tell the firmware how to interpret the MICR characters which fall to the right of the rightmost transit symbol. Each of the six bytes is positional and consists of two parts: character type and number.

The three high order bits of each byte mark the character type. The characters can be marked in three ways: check serial # character, account # character, or “skip this character or symbol.”

The five low order bits of each byte contain the number of characters of that type to extract. Most exceptions will not need to use all six bytes; in that case clear the unused bytes to zero.

Bits within Byte	7	6	5	4	3	2	1	0
check serial # character string	0	0	1	n	n	n	n	n
account # character string	0	1	0	n	n	n	n	n
character string to ignore	1	0	0	n	n	n	n	n

Example 1

t123456780t12349876543210o	1234 is the check serial # 9876543210 is the account #
----------------------------	---

To load the second table entry, which starts at word 25, the transit number 123456780 would be stored in the first two words of its table entry using this string of commands:

```
0x1B 0x73 0x12 0x34 25
0x1B 0x73 0x56 0x78 26
```

After the right transit symbol are immediately the four characters of the check serial #, followed immediately by the ten characters of the account number. These would be bitwise encoded as:

and 0 0 1 0 0 1 0 0 (check #, four characters)
 0 1 0 0 1 0 1 0 (account #, 10 characters)

then stored in the other three words of the table entry using:

```
0x1B 0x73 0x24 0x4A 27
0x1B 0x73 0x00 0x00 28
0x1B 0x73 0x00 0x00 29
```

Example 2

t22137-632t001 6042202o927540 2754 is the check serial #
6042202 is the account #

To load the third table entry, which starts at word 30, the transit number 2137-632 would be stored in the first two words of its table entry using this string of commands:

```
0x1B 0x73 0x22 0x13 30
0x1B 0x73 0x76 0x32 31
```

After the right transit symbol are four characters to skip, a seven digit account number, two characters to skip, and finally a four digit check serial #. The final character to skip need not be encoded. These would be bitwise encoded as:

```
1 0 0 0 0 1 0 0 (skip four characters)
0 1 0 0 0 1 1 1 (account #, seven characters)
1 0 0 0 0 0 1 0 (skip two characters)
0 0 1 0 0 1 0 0 (check #, four characters)
```

then stored in the other three words of the table entry using:

```
0x1B 0x73 0x84 0x47 32  
0x1B 0x73 0x82 0x24 33  
0x1B 0x73 0x00 0x00 34.
```

Maintaining the Exception Table

Present contents of the exception table can be examined using the read NVRAM command:

```
0x1B 0x6A k
```

which reads and returns word k in NVRAM. When the exception table is full, a new entry can replace an older, less frequently used entry, by merely rewriting the words for that table entry.

Appendix A: Specifications

Printing Specifications

	Thermal Receipt Station	Impact Slip Station
Speed	600 Lines / Minute (44 Columns), Depends on Column Width	240, 202, 164, 142 Lines / Minute (40 Columns), Depends on Column Width
Noise Level	50 dBA Sound Pressure (ISO 7779)	68 dBA Sound Pressure (ISO 7779)
Printhead	Direct Thermal, Fixed Head	Impact, Bi-directional
Columns (Maximum)	44 Columns (Standard) 56 Columns (Compressed)	66 Columns (Standard) 80 Columns (Compressed)
Line Spacing	7.6 Lines / Inch	7.2, 6.0, 5.1 Lines / Inch
Character Pitch	15.2 Characters / Inch (Standard) 19.0 Characters / Inch (Compressed)	13.9 Characters / Inch (Standard) 17.1 Characters / Inch (Compressed)
Character Cell	10 x 18 Dots (Standard) 8 x 18 Dots (Compressed)	10 Half Dots x 7 Dots (Standard, Compressed)
Print Modes	Standard, Compressed, Double High, Double Wide, Upside Down, Rotated	Standard, Compressed, Double Wide, Double Strike, Upside Down, Rotated
Character Sets	Code Page 437, Code Page 850	Code Page 437, Code Page 850
Paper Diameter	80 mm Max. (3.15 Inches)	Not Applicable
Paper Length	83 Meters (273 feet)	Side Insertion: 2.0 Inches (Min.) Front Insertion: 2.75 Inches (Min.)
Paper Width	80 mm +/- .2 mm (3.15 Inches +/- .008 Inches)	Side Insertion: 8.0 Inches (Min.) Front Insertion: 2.0 Inches (Min.)
Paper Thickness	Not Applicable	.406 mm (.016 Inch)
Printable Area	3.15 Inches (Max.)	4.75 Inches (Max.)

Power Requirements

The 7156 printer receives power from a separate power supply. Here are the voltage requirements for the power supply.

Voltage	Station	Maximum Current	
		Short Term	Long Term
24.0 V +/- 10%	Slip	4.6 Amps	2.0 Amps
	Receipt	6.5 Amps	2.0 Amps
	When connected with a remote 2x20 pass-through display.		

Environmental Conditions

Operating Temperature	5°C to 45°C (40°F to 112°F), models with knife 5°C to 50°C (40°F to 120°F), models with no knife
Operating Humidity	5% to 90%

Condensation may occur when equipment is transferred from cold to warm areas after shipment. The printer's design permits operation after drying out and stabilizing at room temperature.

Reliability

The numbers in the table refer to the Mean Cycle Between Failure (MCBF) for the items indicated.

Thermal Receipt Printer	36 Million Print Lines
Impact Slip Printer	15 Million Print Lines
Impact Printhead	200 Million Characters
Electronics	240,000 Ontime Hours
Knife	1 Million Cuts
MICR Reader	200,000 Reads
Ribbon Cassette	3 Million Characters
Power Supply	100,000 On-time Hours

Dimensions and Weight

Height	178 mm (7.0 Inches)
Height with Cover Open	280 mm (11.0 Inches)
Width	229 mm (9.0 Inches)
Depth	264 mm (10.4 Inches)
Depth with Extended Slip Table	347 mm (13.7 Inches)
Weight	4.6 Kg (10.1 Pounds), Non-MICR, Includes Paper Roll) 4.8 Kg (10.5 Pounds), MICR and Extended Slip Table

Density of Receipt Print Lines

When the receipt station prints high density print lines (text or graphics), it automatically slows down to a rate slower than 600 lines per minute. High density print lines are defined as lines with over 57% of the dots printing on the line (there are 448 total dot columns on the print station).

Duty Cycle Restrictions (Printing Solid Blocks)

There are restrictions on the duty cycle because of the heat generated by the receipt thermal printhead when printing solid blocks (regardless of the length of the block in relation to the print line). The restrictions are ambient temperature, the percentage of time (measured against one minute) of continuous solid printing, and the amount of coverage.

Caution: When the duty cycle approaches the limits shown in the table, the receipt printhead will heat up and shut down. This may damage the printhead.

To avoid this problem, do one or a combination of the following:

- 1. Reduce the amount of coverage.
- 2. Reduce the time of continuous solid printing.
- 3. Reduce the ambient temperature.

Amount of Solid Coverage	Ambient Temperature		
	25° C	35° C	50° C
20%	100% of 1 min. continuous printing	50% of 1 min. continuous printing	20% of 1 min. continuous printing
40%	50% of 1 min. continuous printing	25% of 1 min. continuous printing	10% of 1 min. continuous printing
100%	20% of 1 min. continuous printing	10% of 1 min. continuous printing	3% of 1 min. continuous printing

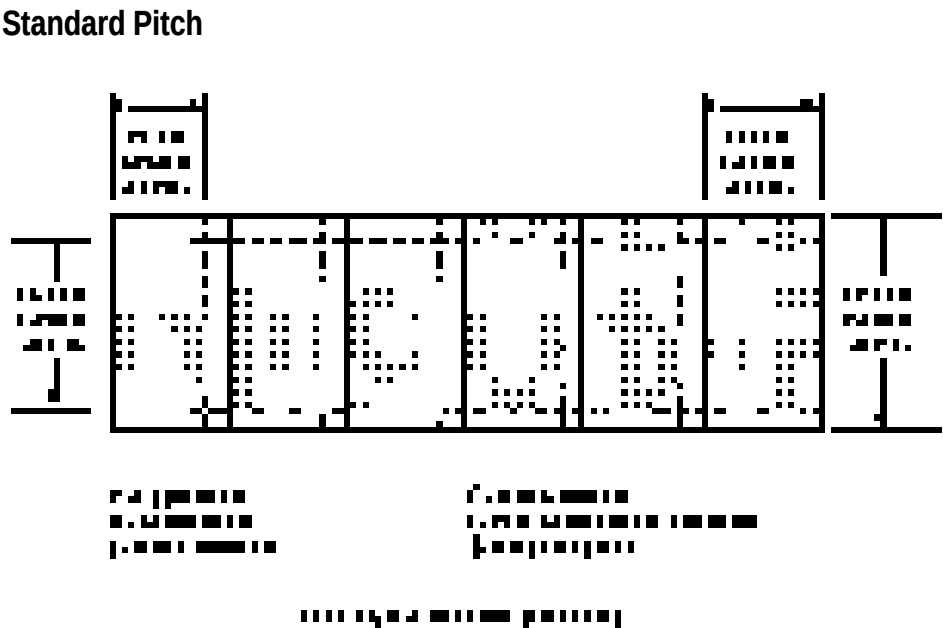
Appendix B: Print Characteristics

Character Size

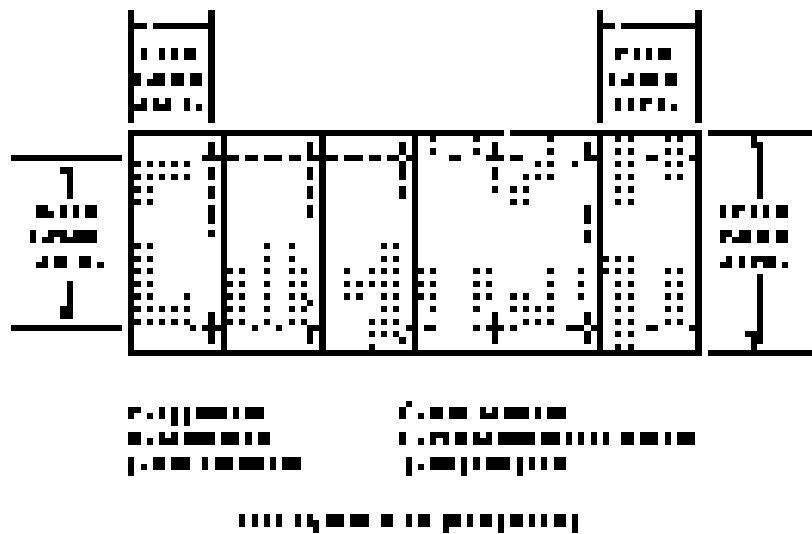
This section shows the dot pattern for characters printed on the receipt and slip stations.

Receipt Station

The following two illustrations show the dot patterns of sample characters for standard pitch (15.2 CPI) and compressed pitch (19 CPI). Note that compressed pitch uses fewer dots horizontally than standard pitch.



Compressed Pitch

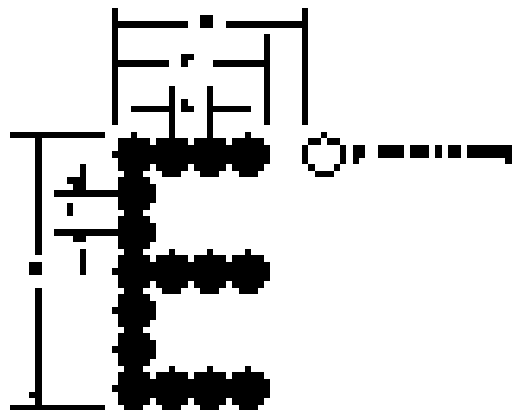


Slip Station

The following illustrations show the dot patterns of sample characters for standard pitch (13.9 CPI), double-wide characters, and rotated characters (counterclockwise).

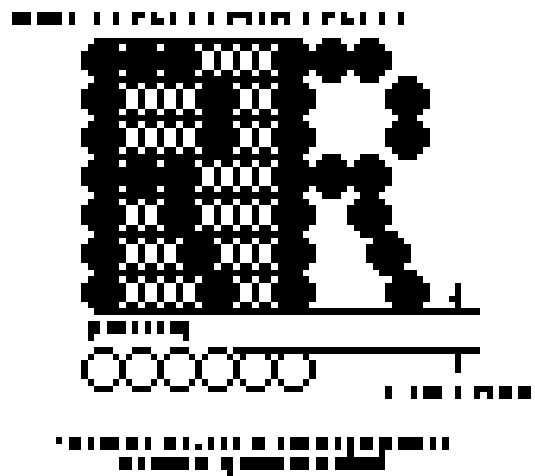
Standard Pitch

The first illustration shows a single character with the dimensions listed in the table that follows (including dimensions for compressed pitch). The second illustration shows the layout of columns for standard pitch characters.



Row spacing is fixed and column spacing depends upon the character pitch as indicated in the table.

Dimension	Standard Pitch (13.9 CPI, 66 Columns)	Compressed Pitch (17.1 CPI, 80 Columns)
A	.366 mm (.0144 in.)	.30 mm (.0117 in.)
B	1.45 mm (.057 in.)	1.24 mm (.049 in.)
C	2.46 mm (.097 in.)	
D	.353 mm (.0139 in.)	
E	1.83 mm (.072 in.)	14.9 mm (.0585 in.)



Note: Columns overlap within the format for each print row in half-dot increments (depending upon pitch), but the printer cannot print overlapping dots on a single print row. No ASCII character contains overlapping dots on a print row.

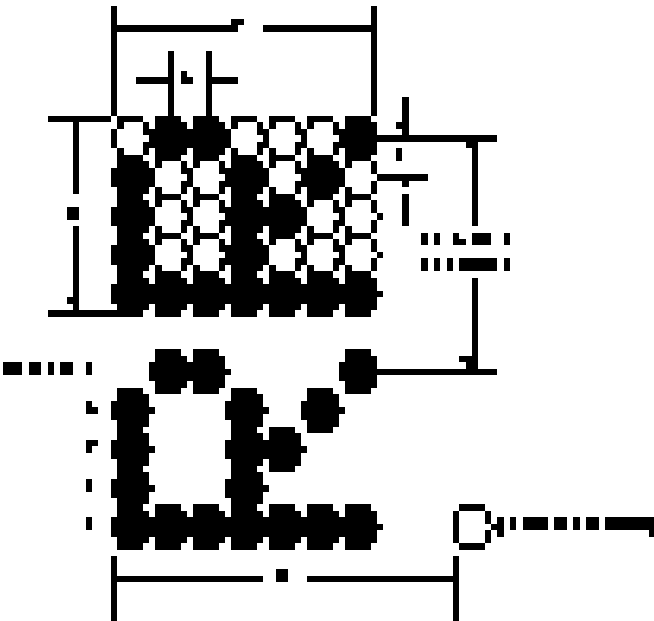
Double-Wide Characters

Double-wide characters are upright characters in an 8x7 dot format with twice the column (horizontal) spacing between printed dots as for standard characters.



Rotated Characters

Rotated characters are alternate characters in a 5x7 dot format printed 90 degrees counterclockwise (as shown in the illustration) or clockwise. Only one horizontal pitch is available: 6.95 CPI, 33 columns maximum.



Dimension	Horizontal Pitch (6.95 CPI, 33 Columns)
A	.366 mm (.0144 in.)
B	2.56 mm (.100 in.)
C	1.75 mm (.069 in.)
D	.353 mm (.0139 in.)
E	3.66 mm (.144 in.)

Print Zones

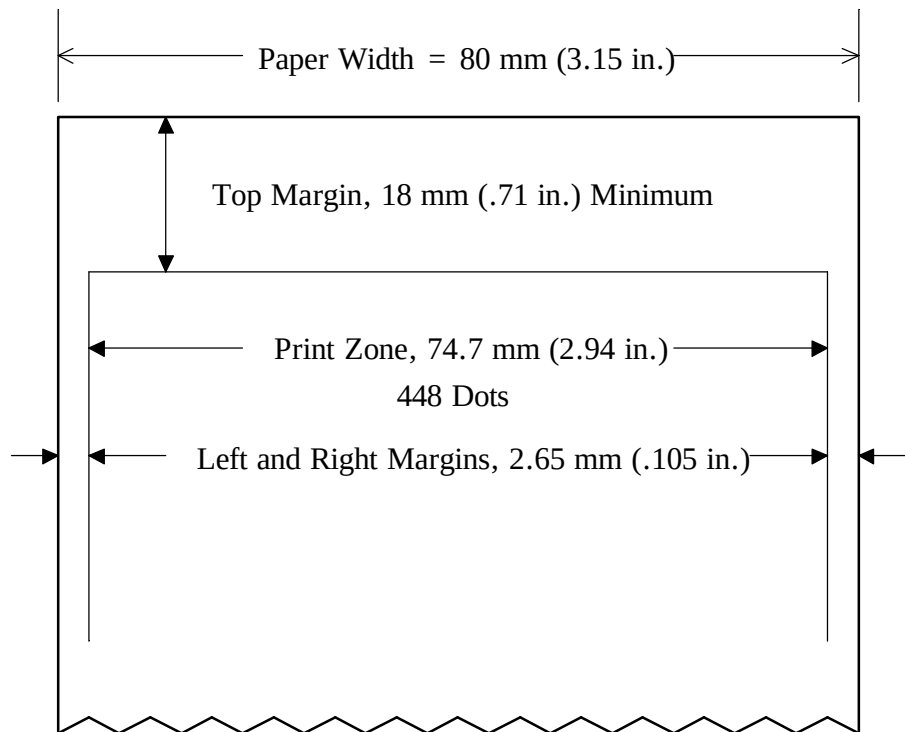
This section shows the printable area for the slip station and the receipt station.

Receipt Station

The receipt station centers characters (standard pitch and compressed pitch) and graphics on an 80 mm wide (3.15 in.) receipt.

- Standard pitch: 10 x 18 dots in character cell, 44 characters (columns) per line
- Compressed pitch: 8 x 18 dots in character cell, 56 characters (columns) per line
- Graphics: 448 addressable bits

The minimum print line height is 18 dots for characters and 24 dots for graphics. The standard print line height is 20 dots (3.33 mm, .131 in.) for characters (with two extra dot rows). See the following illustration (not to scale).

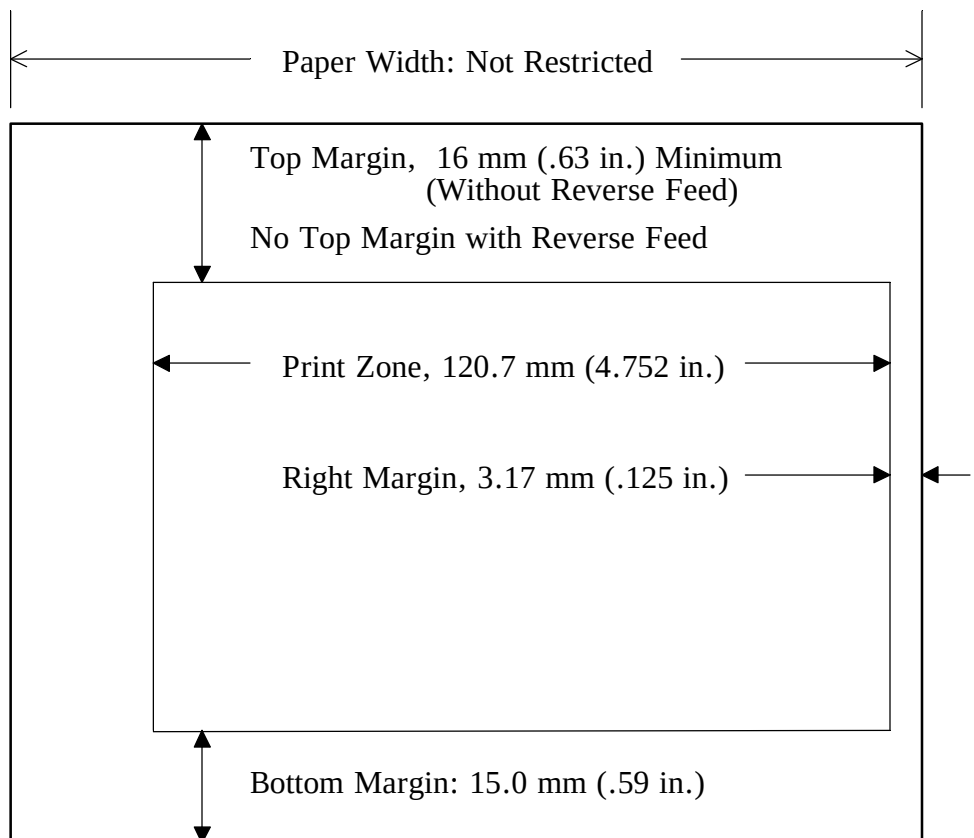


Slip Station

The slip station prints characters (standard pitch and compressed pitch) and graphics in a print zone of 120.7 mm (4.752 in.) wide on a slip or form.

- Standard pitch: 66 characters (columns) per line
- Compressed pitch: 80 characters (columns) per line

The print line height of 7 x 7 dot characters is 2.46 mm (.097 in.). With three-dot spacing, the print line height is 3.53 mm (.139 in.). See the following illustration (not to scale). To print as close to the bottom of the slip as possible without the slip leaving the feed rollers, use the **Print and Feed *n* Lines (1B 64 *n*)**, with $n = 0$.



Character Sets

The next two pages show the character sets for Code Page 437 and Code Page 850.

.	.		C	U	P		E	G	L	U	L	L	A	C	U
		L	.	C	C	X	C	L	X	L	E	L	L	B	L
.	.	.	Z	L	K	H	L	F	L	G	E	T	L	C	U
.		C	2	L	C	.	S	C	A	A	L	F	L	C	C
		C	4	P	L	d	L	S	a	L	+	-	L	A	7
		S	E		L	P	.	L	a	N	A	+	L	C	A
.	.	A	C		V	L	S	S	A	C	A	H	L	P	T
		.	.	L	4	2	W	L	n	C	A	L	L	P	.
.	.	.	J	H	X	H	S	.	V	C	C	L	L	P	*
.	.	)	C		V	L	S	.	C	C	4	F	L	C	
.	.	.		.	7	L	.	L	L	T	L	L	L	L	L
.	.			K	L	L	L	.	a	K	T	T	■	L	L
W	.	.	.	-	C	L	.	.	E	W	A	L	=	V	L
H	.	.		W	L	m	L	.	2	C	P	T	L	L	A
.	K	.	C	H	S	H	.	L	X	C	X	■	L	.	=
U	.	.	L	L	C	.	L	L	C	.	T	S	■	.	.

1. **Identify the main idea or thesis statement of the passage.**

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These changes apply to the main body of the functional specification.

Add these paragraphs after the first paragraph of section 9.6, Printer control codes:

RS232 communication was added in 1994, and some additional industry standard slip handling commands were added at that time. See Appendix II.

Real time commands and Code 128 bar code printing were added late in 1995. These details are in Appendix II in sections 9.8.22 Real Time Commands, and 9.8.23 Code 128 Bar Codes.

Additional industry standard commands were added early in 1997. These details are in Appendix II in sections 9.8.24 New Industry Standard Commands.

Add this as a new second sentence to section 9.7.4, Printer Status Commands:

See Appendix II for additional printer status commands, including Real Time commands and Auto Status Back.

Add this as a new second sentence to section 9.7.5, Bar Code Commands:

See Appendix II for additional bar code commands.

The remaining changes apply to the Appendix II.

Add these second and third paragraphs to the beginning of section 9.7, Printer control codes:

Real time commands and Code 128 bar code printing were added late in 1995. These details are in Appendix II in sections 9.8.22 Real Time Commands, and 9.8.23 Code 128 Bar Codes.

Additional industry standard commands were added early in 1997. These details are in Appendix II in sections 9.8.24 New Industry Standard Commands.

In Section 9.8.1 Print and Eject Slip:

Remove sentence two of paragraph 2.

Add these opening sentences to sections 9.8.16, 9.8.17 and 9.8.18:

All status and data from the printer must be differentiated using the information titled “recognizing data from the printer” in this appendix, section 9.8.22 Real Time Commands.

See section 9.8.24 New industry standard commands for additional status commands and Automatic Status Back (ASB) mode.

In Section 9.8.19 Request Printer Status:

Replace existing description with: This command is ignored.

Replace the table on p. All-22 titled “Recognizing data from the printer” at the end of section 9.8.22, Real Time Commands, leaving the two paragraphs of explanation before the table:

Batch mode response:	Response recognized by:
ESC u 0	0 0 0 0 0 0 x x Binary
ESC v	0 x x 0 0 x x x Binary
ESC w 1 (MICR read)	0 0 0 0 1 1 0 1 Binary (Carriage Return) 0 0 1 x x x x x Binary (0x20 ≤ n ≤ 0x2F) 0 1 x x x x x x Binary (0x30 ≤ n ≤ 0x7F)
GS l n	0 x x 0 x x x x Binary
GS r n	0 x x 0 x x x x Binary
Real Time response:	Response recognized by:
GS EOT n	0 x x 1 x x 1 0 Binary
DLE EOT n	0 x x 1 x x 1 0 Binary
GS ENQ	1 x x x x x x x Binary
XON	0 0 0 1 0 0 0 1 Binary
XOFF	0 0 0 1 0 0 1 1 Binary
Auto Status Back (ASB)	Response recognized by:
ASB byte 1	0 x x 1 x x 0 0 Binary
ASB bytes 2 - 4	0 x x 0 x x x x Binary

Add new section 9.8.24.**9.8.24 New industry standard commands**

These are the new commands:

GS I <i>n</i>	Transmit printer ID.
GS V <i>m n</i>	Select cut mode and cut paper.
GS a <i>n</i>	Enable/disable automatic status back.
GS r <i>n</i>	Transmit status.

The bar code command has been expanded to add an alternate method for printing previously implemented bar codes with $65 \leq m \leq 71$:

GS k <i>m n d1...dn</i>	Print bar code.
-------------------------	-----------------

These commands are recognized with their parameters and are ignored:

GS L <i>nL nH</i>	Set left margin.
GS P <i>x y</i>	Set horizontal and vertical minimum motion units.
GS W <i>nL nH</i>	Set printing area width.

9.8.24.1 Transmit printer ID.

GS I <i>n</i>	Transmit printer ID.			
format	ASCII	GS	I	<i>n</i>
	Hex	1D	49	<i>n</i>
	Decimal	29	73	<i>n</i>
range	$1 \leq n \leq 3, 49 \leq n \leq 51$			

Transmits the printer ID specified by *n* as follows:

<i>n</i>	Printer ID	Specification	ID (hexadecimal)
1, 49	Printer model ID	Axiohm 7156	0x26
2, 50	Type ID	Installed options	refer to table below
3, 51	ROM version ID	ROM version	0x00

$n=2$: Type ID

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	No two-byte character code installed.
	On	01	1	Two-byte character code installed.
1	Off	00	0	No knife installed.
	On	02	2	Knife installed
2	-	-	-	Undefined
3	Off	00	0	No MICR installed.
	On	08	8	MICR installed
4	Off	00	0	Not used. Fixed to Off.
5	-	-	-	Undefined
6	-	-	-	Undefined
7	Off	00	0	Not used. Fixed to Off.

When DTR/DSR RS232 communications handshaking control is selected, the printer transmits the one byte response only when the host signal DSR indicates it is ready to receive data.

When XON/XOFF RS232 communications handshaking control is selected, the printer transmits the one byte response regardless of the host signal DSR.

This command is a batch mode command; the response is transmitted after all prior data in the receive buffer has been processed. There may be a time lag between the printer receiving this command and transmitting the response, depending on the receive buffer status.

When Auto Status Back (ASB) is enabled using **GS a n** , the status transmitted by **GS I n** and the ASB status must be differentiated using the information titled “recognizing data from the printer” in this appendix, section 9.8.22 Real Time Commands.

When n is out of the specified range, this command is ignored.

9.8.24.2 Select cut mode and cut paper.

GS V <i>m</i>	Select cut mode and cut paper.			
format	ASCII	GS	V	<i>m</i>
	Hex	1D	56	<i>m</i>
	Decimal	29	86	<i>m</i>
range	$0 \leq m \leq 1, 48 \leq m \leq 49$			

GS V <i>m n</i>	Select cut mode and cut paper.				
format	ASCII	GS	V	<i>m</i>	<i>n</i>
	Hex	1D	56	<i>m</i>	<i>n</i>
	Decimal	29	86	<i>m</i>	<i>n</i>
range	$65 \leq m \leq 66, 0 \leq n \leq 255$				

There are two formats for this command, one requiring one parameter *m*, the other requiring two parameters *m* and *n*. The format is indicated by the parameter *m*. If *m* is out of the specified range, this command is ignored.

Selects a mode for cutting paper and executes paper cutting. The value of *m* selects the mode as follows:

<i>m</i>	Feed and cut mode
0, 48	Partial cut (no extra feed).
1, 49	Partial cut (no extra feed).
65	Feeds paper to cutting position + (<i>n</i> /360 inch), and cuts the paper partially.
66	Feeds paper to cutting position + (<i>n</i> /360 inch), and cuts the paper partially.

9.8.24.3 Enable/disable automatic status back.

GS a <i>n</i>	Enable/disable automatic status back.			
---------------	---------------------------------------	--	--	--

format	ASCII	GS	a	<i>n</i>
	Hex	1D	61	<i>n</i>
	Decimal	29	97	<i>n</i>

Enables or disables Auto Status Back (ASB) and specifies the status items to include, using *n* as follows:

Bit	Off/On	Hex	Decimal	Status for ASB
0	Off	00	0	Cash drawer status disabled.
	On	01	1	Cash drawer status enabled.
1	Off	00	0	RS232 Busy status disabled.
	On	02	2	RS232 Busy status enabled.
2	Off	00	0	Error status disabled.
	On	04	4	Error status enabled.
3	Off	00	0	Receipt paper roll status disabled.
	On	08	8	Receipt paper roll status enabled.
4	-	-	-	Undefined
5	Off	00	0	Slip detector, slip paper status disabled.
	On	20	32	Slip detector, slip paper status enabled.
6	-	-	-	Undefined
7	-	-	-	Undefined

If *n* = 0, ASB is disabled. Default is *n* = 0, ASB disabled.

If error status is enabled, a change in any of these conditions will trigger the ASB:

- receipt cover or cassette cover opened,
- knife error,
- carriage motor jam,
- out-of-range printhead temperature,
- out-of-range voltage,
- receipt paper exhaust if trying to print on the receipt.

ASB is enabled if only one status is selected. The printer automatically transmits four bytes of ASB whenever one of the enabled status conditions changes. When transmitting ASB, the printer transmits four bytes regardless of the host signal DSR.

This command is a batch mode command; it is processed after all prior data in the receive buffer has been processed. There may be a time lag between the printer receiving this command and changing the ASB response, depending on the receive buffer status.

When Auto Status Back (ASB) is enabled using **GS a n**, the status transmitted by other commands and the ASB status must be differentiated using the information titled “recognizing data from the printer” in this appendix, section 9.8.22 Real Time Commands.

The status bytes to be transmitted are as follows:

First byte, printer information:

Bit	Off/On	Hex	Decimal	Status for ASB
0	Off	00	0	Not used. Fixed to off.
1	Off	00	0	Not used. Fixed to off.
2	Off	00	0	One or both cash drawers open.
	On	04	4	Both cash drawers closed.
3	Off	00	0	Not Busy at the RS232 interface.
	On	08	8	Printer is Busy at the RS232 interface.
4	On	10	16	Not used. Fixed to on.
5	Off	00	0	Receipt and cassette cover both closed.
	On	20	32	Receipt or cassette cover open.
6	Off	00	0	Paper feed button is not pressed.
	On	40	64	Paper feed button is pressed.
7	Off	00	0	Not used. Fixed to off.

Second byte, error information:

Bit	Off/On	Hex	Decimal	Status for ASB
0	-	-	-	Undefined
1	-	-	-	Undefined
2	Off	00	0	No mechanical error.
	On	04	4	Mechanical error occurred.
3	Off	00	0	No knife error.
	On	08	8	Knife error occurred.
4	Off	00	0	Not used. Fixed to off.
5	Off	00	0	No unrecoverable error.
	On	20	32	Unrecoverable error occurred.
6	Off	00	0	No recoverable error.
	On	40	64	Recoverable error occurred. Recoverable errors are: receipt cover open prevents receipt print cassette cover open prevents slip print receipt paper exhaust prevents receipt print thermal printhead temperature out of range power supply voltage temperature out of range
7	Off	00	0	Not used. Fixed to off.

Third byte, paper sensor information:

Bit	Off/On	Hex	Decimal	Status for ASB
0	Off	00	0	Receipt paper adequate.
	On	01	1	Receipt paper low.
1	Off	00	0	Receipt paper adequate.
	On	02	2	Receipt paper low.
2	Off	00	0	Receipt paper present.
	On	04	4	Receipt paper exhausted.
3	Off	00	0	Receipt paper present.
	On	08	8	Receipt paper exhausted.
4	Off	00	0	Not used. Fixed to off.
5	Off	00	0	Slip leading edge sensor: paper present.
	On	20	32	Slip leading edge sensor: no paper.
6	Off	00	0	Slip trailing edge sensor: paper present.
	On	40	64	Slip trailing edge sensor: no paper.
7	Off	00	0	Not used. Fixed to off.

Fourth byte, slip paper detector information:

Bit	Off/On	Hex	Decimal	Status for ASB
0	Off	00	0	Slip paper is selected.
	On	01	1	Receipt paper is selected.
1	Off	00	0	Possible to print on slip.
	On	02	2	Not possible to print on slip because not inserted yet.
2	-	-	-	Undefined
3	-	-	-	Undefined
4	Off	00	0	Not used. Fixed to off.
5	-	-	-	Undefined
6	-	-	-	Undefined
7	Off	00	0	Not used. Fixed to off.

9.8.24.4 Transmit status.

GS r n	Transmit status.			
format	ASCII	GS	r	n
	Hex	1D	72	n
	Decimal	29	114	n
range	$1 \leq n \leq 3, 49 \leq n \leq 51$			

Transmits the status specified by n , as follows:

n	Function
1, 49	Transmits printer status.
2, 50	Transmits cash drawer status (same as ESC u 0).
3, 51	Transmits slip paper status.

When DTR/DSR RS232 communications handshaking control is selected, the printer transmits the one byte response only when the host signal DSR indicates it is ready to receive data.

When XON/XOFF RS232 communications handshaking control is selected, the printer transmits the one byte response regardless of the host signal DSR.

This command is a batch mode command; the response is transmitted after all prior data in the receive buffer has been processed. There may be a time lag between the printer receiving this command and transmitting the response, depending on the receive buffer status.

When Auto Status Back (ASB) is enabled using **GS a n**, the status transmitted by **GS r n** and the ASB status must be differentiated using the information titled “recognizing data from the printer” in this appendix, section 9.8.22 Real Time Commands.

When n is out of the specified range, this command is ignored.

The status types to be transmitted are shown below.

Printer status ($n = 1$ or $n = 49$):

Bit	Off/On	Hex	Decimal	Status for GS r n
0	Off	00	0	Receipt paper adequate.
	On	01	1	Receipt paper low.
1	Off	00	0	Receipt paper adequate.
	On	02	2	Receipt paper low.
2	Off	00	0	Receipt paper present.
	On	04	4	Receipt paper exhausted.
3	Off	00	0	Receipt paper present.
	On	08	8	Receipt paper exhausted.
4	Off	00	0	Not used. Fixed to off.
5	Off	00	0	Slip leading edge sensor: paper present.
	On	20	32	Slip leading edge sensor: no paper.
6	Off	00	0	Slip trailing edge sensor: paper present.
	On	40	64	Slip trailing edge sensor: no paper.
7	Off	00	0	Not used. Fixed to off.

Cash drawer status ($n = 2$ or $n = 50$):

Bit	Off/On	Hex	Decimal	Status for GS r n
0	Off	00	0	One or both cash drawers open.
	On	01	1	Both cash drawers closed.
1	Off	00	0	One or both cash drawers open.
	On	02	2	Both cash drawers closed.
2	-	-	-	Undefined
3	-	-	-	Undefined
4	Off	00	0	Not used. Fixed to off.
5	-	-	-	Undefined
6	-	-	-	Undefined
7	Off	00	0	Not used. Fixed to off.

Slip paper status ($n = 3$ or $n = 51$):

Value of byte returned	Slip Status
0	There is no more printing space on the current slip, or slip paper is not selected.
1 to 8	- Remaining print area on the current slip, in number of lines, at the currently set line spacing, when the trailing edge sensor has become uncovered. - Until the trailing edge sensor becomes uncovered the value reported will be 6, because there are at least 6 lines remaining. - There can be 7 or 8 lines remaining when the slip line spacing has been set to less than 7.2 lines per inch.

9.8.24.5 Print bar code.

GS k . . .	Print bar code				
format	ASCII	GS	k	m	n [d]n
	Hex	1D	6B	m	n [d]n
	Decimal	29	107	m	n [d]n
range	$65 \leq m \leq 71, 1 \leq n \leq 255, 0 \leq d \leq 127$				

The bar code command has been expanded to add an alternate method for printing previously implemented bar codes with $65 \leq m \leq 71$.

The command selects a bar code system and prints the bar code. The value of m selects the bar code system as follows:

m	Bar Code System	Number of Characters	Values of d
65	UPC-A	fixed, $11 \leq n \leq 12$	$48 \leq d \leq 57$ (ASCII numerals)
66	UPC-E	fixed, $11 \leq n \leq 12$	$48 \leq d \leq 57$
67	JAN13 (EAN)	fixed, $12 \leq n \leq 13$	$48 \leq d \leq 57$
68	JAN8 (EAN)	fixed, $7 \leq n \leq 8$	$48 \leq d \leq 57$
69	CODE39	variable	$48 \leq d \leq 57$, $65 \leq d \leq 90$ (ASCII alphabet), $d = 32, 36, 37, 43, 45, 46, 47$ (ASCII special characters), $d1 = dk = 42$ (start/stop code is supplied by printer if necessary)
70	Interleaved 2 of 5 (ITF)	variable (even number)	$48 \leq d \leq 57$
71	CODABAR (NW-7)	variable	$65 \leq d \leq 68$ start code, $48 \leq d \leq 57$, $d = 36, 43, 45, 46, 47, 58$

This command is valid only at the beginning of a line. When data exists in the print buffer, the printer processes the data following m as normal data.

The variable n indicates the number of bytes of bar code data, and the printer processes n bytes from the next character data as bar code data.

If n is out of range for a fixed length bar code system, the printer will attempt to encode the following data, but an invalid bar code pattern may result.

The variable d indicates the character code to be encoded into the specified bar code system.

If character code d cannot be encoded, the printer prints the bar code data processed so far, and the following data is treated as normal data.

If the encoded bar code pattern exceeds one line, the printer does not print the excess data.

8.2.3 Receipt Throughput

Models 7156-3xxx are the original models. Models 7156-4xxx have higher receipt print speed and were introduced in 1997.

	Model 7156-3xxx	Model 7156-4xxx
Dot line period	5.0 ms. maximum	3.0 ms. maximum
Paper speed	1.3 "/second 33 mm./second	2.25"/second 57 mm./second
Print line rate, at 7.6 lpi standard pitch	600 lines/minute 10 lines/second	1020 lines/minute 17 lines/second

Note on models 7156-4xxx:

In order for an application to fully realize the faster print speed it must ensure that data to be printed arrives at the printer at least as fast as it is printed. And it must allow receipt lines to be buffered ahead at the printer, so the printer will be able to print each line immediately after the preceding line, without stopping to wait for more data. Ideally, an application will send all the data for an entire customer receipt without pausing between characters or lines transmitted.

At 9600 baud data rate, it takes approximately 1 millisecond to transmit one character of data; at 19.2 K baud it takes 500 microseconds. The application should maintain this rate for all the data to be printed. It takes approximately 60 milliseconds for the printer to process the data and print one line. If individual characters are sent at 9600 baud, but the application pauses between lines for merely 50 milliseconds, the printer will never be able to print at full speed.

Some timing examples, with an application delay of 50 milliseconds after each line, show that for either baud rate the transmit time equals or exceeds the print time, forcing the printer to pause between lines, waiting for data to print:

	characters/line	lines/receipt	transmit time, 9600 baud	transmit time, 19.2 K baud	print time
	20	20	1.4 sec	1.2 sec	1.2 sec
	20	40	2.8 sec	2.4 sec	2.4 sec
	44	20	1.88 sec	1.44 sec	1.2 sec
	44	40	3.76 sec	2.88 sec	2.4 sec

The same examples, with no delay between lines transmitted, show that for either baud rate the transmit time is much less than the print time, allowing the printer to print the lines at full speed:

	characters/line	lines/receipt	transmit time, 9600 baud	transmit time, 19.2 K baud	print time
	20	20	0.4 sec	0.2 sec	1.2 sec
	20	40	0.8 sec	0.4 sec	2.4 sec
	44	20	0.88 sec	0.44 sec	1.2 sec
	44	40	1.76 sec	0.88 sec	2.4 sec

Enhanced features

Faster thermal print and knife cut

This table shows the progression from the original 7156, to the 7156-4xxx released in 1997, to the A756-8xxx described in this appendix.

	Model 7156-3xxx	Model 7156-4xxx	Model A756-8xxx
Dot line period	5.0 ms. maximum	3.0 ms. maximum	2.7 ms. maximum
Paper speed	1.3 in./second 33 mm./second	2.25 in./second 57 mm./second	2.44 in./second 62 mm./second
Print line rate, at 7.6 lpi standard pitch	600 lines/minute 10 lines/second	1020 lines/minute 17 lines/second	1110 lines/minute 18.6 lines/second
Knife cut time	1.1 seconds	0.8 seconds	0.6 seconds
Transaction time to feed last line past knife, and cut	1.6 seconds	1.2 seconds	0.9 seconds

The thermal print speed is affected slightly by cold temperature and number of dots printed, but standard text receipts at room temperature will run at the new higher speed. This duty cycle limitation is imposed by the printer firmware. This table shows the new affect of temperature and a moderately high dot density:

	< 10 degrees C	< 20 degrees C	20 to 75 degrees C
0 to 220 dots	42 mm per second	57 mm per second	62 mm per second
221 to 255 dots	42 mm per second	42 mm per second	57 mm per second
256 to 448 dots	High density print, no change to current operation.		

Faster RS232 communications

The slowest baud rate, 1200 baud, has been replaced by 38.4K baud, twice as fast as the previously highest rate of 19.2K baud.

The switch setting for 38.4 baud is the same as was used to select 1200 baud:

Switch 5 ON
Switch 6 ON

Expanded dip switches

There are now 10 dipswitches instead of eight. Configuration of switches 1 through 8 is unchanged from other 7156 models, except for the new RS232 baud rate. New switches 9 and 10 are used in combination with the other switches for the new options.

Switches					
1	2-6	7	8	9	10
Off	Comm options	Off	ON = Knife	Off = RS232 ON = Parallel	ON = check flip option
ON	Comm options	Off	Off	Off = RS232 ON = Parallel	ON = download mode

There is one new parameter entered into nvram using dipswitches similar to the way the thermal printhead setting is done. The MICR decode method is now set in manufacturing to either E13B or to CMC7 using these switch settings:

Switches							Diagnostic meaning
1	2	3	4	5	6	7-10	
On	Off	On	On	On	Off	Off	E13B
On	Off	On	On	On	On	Off	CMC7

Diagnostic printout

There is more information contained in the diagnostic printout. New items are the model number and serial number, the part numbers for the boot processor firmware and the flash executable firmware, and two sets of tallies. If the model and serial numbers have not been programmed in at manufacturing time these fields will be blank. See the 'Remote Diagnostics' section for full details about the new items.

Logo and user-defined character set

In previous models of the 7156 an application could store and print a logo, or could create and print from a user-defined character set, but could not do both, since they shared the same internal memory. Now an application can do both on the same receipt without reloading either. This is in addition to the ability to store logos and user-defined characters in flash memory.

The commands to define, select, and print a logo and character set have not changed. No new commands are required to take advantage of this enhancement.

The command to initialize the printer to power-on conditions ('ESC @') will cancel any logo or user-defined character residing in ram (volatile memory) only, but definitions in flash will be maintained.

User accessible flash memory

Description

The A756-8xxx provides two 64K pages of non-volatile flash memory that are user accessible. The advantage of flash memory is that when written, the contents are preserved over a printer power cycle. Flash memory remains intact until it is erased. Flash memory can be written one byte at a time, but it cannot be erased one byte at a time: an entire 64K page must be erased at once. The A756-8xxx offers new commands to support user access to flash memory.

One 64K page is available for user-defined characters and multiple logos. The original commands to define and print user-defined characters and logos remain unchanged. New commands handle access to multiple logos, user-defined characters in flash, and flash memory management.

An existing application, without any changes, will gain the benefit of having a logo stored in flash automatically: in case of an inadvertent power cycle, the logo is still preserved.

However user-defined characters are not automatically stored in flash, to prevent possibly printing the wrong characters after a printer power cycle. Application changes are needed to store user-defined characters in flash.

The other 64K page is available for user data storage. This is a completely new feature, and new commands handle reads, writes, and memory management.

Identification of flash

The existing Transmit Printer ID command will tell an application that the printer connected is the A756-8xxx, with flash memory:

GS I <i>n</i>	Transmit Printer ID.			
format	ASCII	GS	I	<i>n</i>
	Hex	1D	49	<i>n</i>
	Decimal	29	73	<i>n</i>
range	$1 \leq n \leq 3, 49 \leq n \leq 51$			

Transmits the printer ID specified by *n* as follows:

<i>n</i>	Printer ID	Specification	ID (hexadecimal)
1, 49	Printer model ID	Axiohm A756	0x26
2, 50	Type ID	Installed options	refer to table below
3, 51	ROM version ID	ROM version	0x00

n=2 or 50: Type ID

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	No two-byte character code installed.
	On	01	1	Two-byte character code installed.
1	Off	00	0	No knife installed.
	On	02	2	Knife installed
2	-	-	-	Undefined
3	Off	00	0	No MICR installed.
	On	08	8	MICR installed
4	Off	00	0	Not used. Fixed to Off.
5	Off	00	0	A756-4xxx, no flash memory installed. * * * new
	On	20	32	A756-8xxx, flash memory installed. * * * new
6	-	-	-	Undefined
7	Off	00	0	Not used. Fixed to Off.

Erasing flash

GS @ <i>n</i>	Erase flash.			
format	ASCII	GS	@	<i>n</i>
	Hex	1D	40	<i>n</i>
	Decimal	29	64	<i>n</i>
range	$49 \leq n \leq 50$			

The printer erases a page of flash and sends a Carriage Return (0x0D) when the erase is complete.

***n* = 49** (ASCII '1' only)

This command will erase the entire 64K page available for user-defined characters and multiple logos. The page needs to be erased in two cases: when the logo definition area is full and an application wants to define new logos, and when the application wants to replace one user-defined character set with another. In either case, all character definitions and logos are erased and must be redefined.

***n* = 50** (ASCII '2' only)

This command will erase the entire 64K page available for user data storage.

Important application note:

While flash is being erased, the printer must disable all interrupts, including communications. To provide feedback to the application, the printer responds to the application when the erase is complete. After sending this command, an application should just wait for the response from the printer before sending any more data. Data will be lost otherwise. If an application cannot receive any data for some reason, it should wait a minimum of five seconds after sending a flash erase command before sending any more data.

Multiple logos

GS # <i>n</i>	Select active logo.			
format	ASCII	GS	#	<i>n</i>
	Hex	1D	23	<i>n</i>
	Decimal	29	35	<i>n</i>
range	$0 \leq n \leq 255$			

This command selects a logo to be defined or printed. The active logo number *n* remains in effect until this command is sent again with another number *n*.

When this command precedes a logo definition, that definition will be stored in flash memory as logo *n*. If there is already a different definition in flash for logo *n*, the first is inactivated and the new definition becomes logo *n*. The inactive definition is not erased from flash and continues to take up flash memory space.

When this command precedes a logo print command, and *n* is different from the previously active logo selected, the printer will retrieve the logo definition for *n* from flash and print it. If there is no logo definition in flash for *n*, then no logo is printed.

If the printer never receives this command – the case for an existing unchanged application, expecting only one possible logo – the printer will assign **0** (zero) as the active logo identifier. It will automatically store any new logo definition in flash as logo **0**, inactivating any previous logo **0** definition. If the flash available for logos fills up with inactive logo **0** definitions, the firmware will erase old definitions at the next power cycle. This is the only case when the printer will erase flash memory without an application command.

Once this command is used – the case for a new application using multiple logos – the printer will no longer automatically erase the logo definition page when it fills with multiple definitions. A new application using multiple logos, or writing a user-defined character set into flash, or both, is responsible for erasing the logo and user-defined character set flash sector when the logo area is full or before a new user character set is defined.

The 64K page available for user-defined characters and multiple logos is divided into three parts:

<u>memory, in bytes</u>	
thermal character definitions	8,288
impact character definitions	2,464
logos	54,784

The character definition area is fixed; 224 characters can be defined for both the receipt and slip.

There is no change to maximum logo dimensions. Each logo can be up to 448 dots wide, or 384 dots high, with a maximum definition of 10,760 bytes, including the 8-byte header maintained in the printer. The number of logos which will fit into flash depends on the size of the definitions. Each application will be different, but here are some examples of logo sizes and flash memory requirements:

Width		Height		Memory req'd	
Inches	Dots	Inches	Dots	Bytes	Volume
2.94	448	1.26	192	10,760	20%
1.47	224	2.52	384	10,760	20%
2.21	336	1.68	256	10,760	20%
1.89	288	1.89	288	10,376	19%
1.0	152	1.0	152	2,896	6%
2.0	304	1.0	152	5,784	11%

Selective load to flash memory

GS „ <i>n</i>	Load to flash or ram.				
format	ASCII	GS	„	<i>n</i>	
	Hex	1D	22	<i>n</i>	
	Decimal	29	34	<i>n</i>	
range	$48 \leq n \leq 51$				

This command specifies whether to load logos or user-defined characters to flash memory or to ram (volatile memory). The selection remains in effect until changed via command or until power cycle.

***n* = 48** (ASCII '0' only)

Load active logo to ram only. This would be used by an application wanting to print a special logo but not have it take up flash memory. Any logo defined following this command will not be preserved over power cycle.

***n* = 49** (ASCII '1' only)

Load active logo to flash memory. This is the default condition for logo flash storage. Any logo defined following this command will be stored in flash memory.

***n* = 50** (ASCII '2' only)

Load user-defined characters to ram only. This is the default condition for user-defined character storage. Any user-defined characters defined following this command will not be preserved over power cycle.

***n* = 51** (ASCII '3' only)

Load user-defined characters to flash memory. An application must use this command to store user-defined characters in flash memory. Any user-defined characters defined following this command will be stored in flash. A user-defined character cannot be redefined in flash. The flash page must be erased by an application before redefining any user-defined characters.

User data storage

ESC ' <i>m addr data</i>	Write to user data storage.
--------------------------	-----------------------------

format	ASCII	ESC ' <i>m</i>	<i>3-byte addr</i>	<i>m-byte data</i>
	Hex	1B 27 <i>m</i>	<i>3-byte addr</i>	<i>m-byte data</i>
	Decimal	27 39 <i>m</i>	<i>3-byte addr</i>	<i>m-byte data</i>
range	$0 \leq m \leq 255$			
	$0 \leq addr \leq 65,535$			
	$0 \leq data \leq 255$			

Note that the address field is three bytes. The first byte is ignored now, and is available for future expansion to multiple 64K pages of user data storage. The second and third bytes specify an address within a 64K page, in high:low format.

This command writes *m* bytes of data to the user data storage flash page at the address specified. The printer will wait for *m* bytes of data following the 3-byte address *addr*. If *m*=0, the printer will wait for 256 bytes of data. If any of the *m* locations starting at *addr* in flash have already been written to, the printer will not write any of the data for this command string. See the associated flash status command for obtaining the results of this command.

ESC 4 <i>m addr data</i> Read from user data storage.				
format	ASCII	ESC 4 <i>m</i>	<i>3-byte addr</i>	
	Hex	1B 34 <i>m</i>	<i>3-byte addr</i>	
	Decimal	27 52 <i>m</i>	<i>3-byte addr</i>	
range	$0 \leq m \leq 255$			
	$0 \leq addr \leq 65,535$			

Note that the address field is three bytes. The first byte is ignored now, and is available for future expansion to multiple 64K pages of user data storage. The second and third bytes specify an address within a 64K page, in high:low format.

This command reads *m* bytes of data from the user data storage flash page at the address specified, and returns them to the application. If *m*=0, the printer will read and return 256 bytes of data. The printer sends a Carriage Return (0x0D) following the final byte of data.

Flash status

One of the existing Transmit status commands is extended to provide information about the user accessible flash memory and associated command results. The original parameters for this command are unchanged. Flash status is implemented with a new parameter.

GS r n	Transmit status.			
format	ASCII	GS	r	n
	Hex	1D	72	n
	Decimal	29	114	n
range	$1 \leq n \leq 4, 49 \leq n \leq 52$			

Transmits the status specified by *n*, as follows:

<i>n</i>	Function
1, 49	Transmits printer status.
2, 50	Transmits cash drawer status (same as ESC u 0).
3, 51	Transmits slip paper status.
4, 52	Transmits flash memory status. * * * new

When DTR/DSR RS232 communications handshaking control is selected, the printer transmits the one byte response only when the host signal DSR indicates it is ready to receive data.

When XON/XOFF RS232 communications handshaking control is selected, the printer transmits the one byte response regardless of the host signal DSR.

This command is a batch mode command; the response is transmitted after all prior data in the receive buffer has been processed. There may be a time lag between the printer receiving this command and transmitting the response, depending on the receive buffer status.

When Auto Status Back (ASB) is enabled using **GS a n**, the status transmitted by **GS r n** and the ASB status must be differentiated using the information titled „recognizing data from the printer“ in earlier documentation.

When *n* is out of the specified range, this command is ignored.

The flash memory status contains the following information:

Flash memory status ($n = 4$ or $n = 52$):

Bit	Off/On	Hex	Decimal	Status for GS r 4
0	Off	00	0	Undefined. Fixed to off.
1	Off	00	0	Undefined. Fixed to off.
2	Off	00	0	User data storage write successful.
	On	04	4	User data storage write failed, specified area not erased.
3	Off	00	0	Flash logo area adequate, definition stored.
	On	08	8	Flash logo area not adequate for recent definition.
4	Off	00	0	Not used. Fixed to off.
5	Off	00	0	No thermal user-defined characters written to flash.
	On	20	32	Thermal user-defined characters written to flash.
6	Off	00	0	No impact user-defined characters written to flash.
	On	40	64	Impact user-defined characters written to flash.
7	Off	00	0	Not used. Fixed to off.

Remote Diagnostics

The A756-8xxx provides new remote diagnostics capabilities. They offer the ability to retrieve critical printer information from the printer via communications, which can aid in maintaining a state of health picture of an installation. They also provide the means for on-site customization of replacement boards.

The existing Transmit Printer ID command is extended to provide the new remote diagnostics feature. The original parameters for this command are unchanged. The new feature is implemented with a new parameter and various extensions.

Remote diagnostics extension:

GS I @ <i>n</i>	Transmit Printer ID, Remote Diagnostics Extension.				
format	ASCII	GS	I	@	<i>n</i>
	Hex	1D	49	40	<i>n</i>
	Decimal	29	73	64	<i>n</i>
range	$32 \leq n \leq 255$, not all defined but reserved				

There are 11 remote diagnostic items defined: six printer ID items, and five printer tally items. Each item has a group of four remote diagnostic functions assigned to it, but not all functions are available for each item. Most of the items are maintained in the printer's non-volatile memory (NVRAM); some are contained in read-only memory (ROM). The table below describes all these variables.

The first item group in the table shows an example of data to send and data to receive. Data sent from the host to write to NVRAM must contain all digits required by the remote diagnostic item. All data must be ASCII. The printer returns all ASCII data, preceded by the parameter *n* to identify the diagnostic item, followed by a Carriage Return (<CR>) to signify end of data.

The command performs the remote diagnostic function specified by *n* as follows:

GS I @ <i>n</i>			REMOTE DIAGNOSTIC ITEM	FUNCTION
ASC	hex	dec		
space	20	32	Serial #, 10 digit ASCII	Write to NVRAM Example, send 14 bytes to printer: GS I @ 0x20 1234567890
!	21	33	Serial #	Write to NVRAM, and print on receipt to verify Example, send 14 bytes to printer: GS I @ ! 1234567890 This will print on receipt: Serial # written: 1234567890
,	22	34	Serial #	Not available, cannot clear Serial # item

GS I @ <i>n</i>			REMOTE DIAGNOSTIC ITEM	FUNCTION
ASC	hex	dec		
#	23	35	Serial #	Return Serial #, preceded by <i>n</i> to identify Printer returns 12 bytes in above example: #1234567890<CR>
\$	24	36	Class/model #, 15 digit ASCII	Write to NVRAM
%	25	37	Class/model #	Write to NVRAM, and print on receipt to verify
&	26	38	Class/model #	Not available, cannot clear Class/model # item
'	27	39	Class/model #	Return Class/model #, returns 17 bytes
(	28	40	Boot firmware part #	Not available, cannot write to ROM
)	29	41	Boot firmware part #	Not available, cannot write to ROM
*	2A	42	Boot firmware part #	Not available, cannot write to ROM
+	2B	43	Boot firmware part #, 12 digit ASCII	Return Boot firmware part #, returns 14 bytes
,	2C	44	Boot firmware CRC	Not available, cannot write to ROM
-	2D	45	Boot firmware CRC	Not available, cannot write to ROM
.	2E	46	Boot firmware CRC	Not available, cannot write to ROM
/	2F	47	Boot firmware CRC, 4 digit ASCII	Return Boot firmware CRC, returns 6 bytes
0	30	48	Flash firmware part #	Not available, cannot write to ROM
1	31	49	Flash firmware part #	Not available, cannot write to ROM
2	32	50	Flash firmware part #	Not available, cannot write to ROM
3	33	51	Flash firmware part #, 12 digit ASCII	Return Flash firmware part #, returns 14 bytes
4	34	52	Flash firmware CRC	Not available, cannot write to ROM
5	35	53	Flash firmware CRC	Not available, cannot write to ROM
6	36	54	Flash firmware CRC	Not available, cannot write to ROM
7	37	55	Flash firmware CRC, 4 digit ASCII	Return Flash firmware CRC, returns 6 bytes
Ç	80	128	Receipt lines tally, 8 digit ASCII numeric, max 99,999,999	Write to NVRAM Example, send 12 bytes to printer: GS I @ Ç00010000 To set receipt lines tally to 10,000
ü	81	129	Receipt lines tally	Write to NVRAM, and print on receipt to verify Example, send 12 bytes to printer: GS I @ ü00010000 This will print on receipt: Receipt tally written: 10,000
é	82	130	Receipt lines tally	Clear receipt lines tally to 0
â	83	131	Receipt lines tally	Return receipt lines tally, preceded by <i>n</i> to identify Printer returns 10 bytes in above example: â00010000<CR>

GS I @ <i>n</i>			REMOTE DIAGNOSTIC ITEM	FUNCTION
ASC	hex	dec		
ä	84	132	Knife cut tally, 8 digit ASCII numeric, max 99,999,999	Write to NVRAM
à	85	133	Knife cut tally	Write to NVRAM, and print on receipt to verify
å	86	134	Knife cut tally	Clear knife cut tally to 0
ç	87	135	Knife cut tally	Return knife cut tally, returns 10 bytes
ê	88	136	Slip character tally, 8 digit ASCII numeric, max 99,999,999	Write to NVRAM
ë	89	137	Slip character tally	Write to NVRAM, and print on receipt to verify
è	8A	138	Slip character tally	Clear slip character tally to 0
ï	8B	139	Slip character tally	Return slip character tally, returns 10 bytes
î	8C	140	MICR read tally, 8 digit ASCII numeric, max 99,999,999	Write to NVRAM
ì	8D	141	MICR read tally	Write to NVRAM, and print on receipt to verify
Ä	8E	142	MICR read tally	Clear MICR read tally to 0
Å	8F	143	MICR read tally	Return MICR read tally, returns 10 bytes
É	90	144	Hours on tally, 8 digit ASCII numeric, max 99,999,999	Write to NVRAM
æ	91	145	Hours on tally	Write to NVRAM, and print on receipt to verify
Æ	92	146	Hours on tally	Clear Hours on tally to 0
ô	93	147	Hours on tally	Return Hours on tally, returns 10 bytes